The Electrical Industry's Weekly Magazine

November 25, 1957

Electrical World

Price 50 Cents

A McGraw-Hill Publication

Report on National Electrical Manufacturers Association Annual Convention
...Page 80

"POWER-UP" for more efficient production

Aerial Cable and Vaults: A Good Bet for Serving Small Business . . . . p 96

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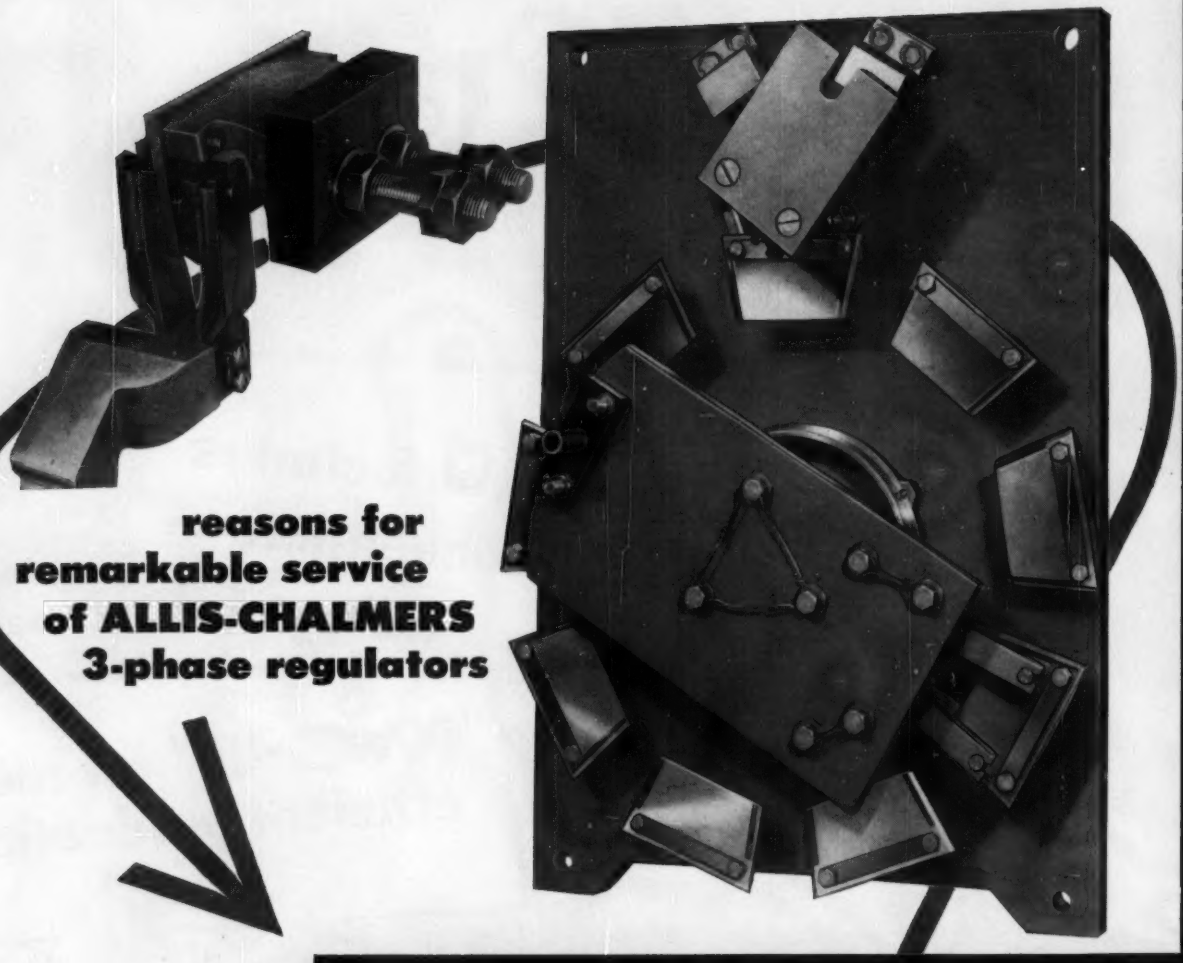

reasons for remarkable service of ALLIS-CHALMERS 3-phase regulators

Longest contact life

Heavy components and rigid design maintain highest contact pressures available in industry and assure long service life because . . .

- High contact pressure minimizes contact blowback caused by severe short circuits.
- Contact bounce and consequent pitting and burning are reduced.
- Large contacts increase thermal capacity.
- Quick-break mechanism snaps contacts fast for reduced arcing time.
- Contacts made of sintered RS-1045 greatly resist pitting and burning.

These are just a few of the many reasons for the outstanding service record of Allis-Chalmers 3-phase regulators. For complete details, contact your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-5459

ALLIS-CHALMERS

Electrical World

Vol. 148, No. 22 November 25, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Features

CURRENT EVENTS

Anti-Trust Suit Explored by Co-ops

Resolution adopted on possible court action against power companies, their organizations, PR firms.....p 78

Are You Set for Retirement?

Con Edison veterans are: They get pre-retirement counseling to cushion the jolt.....p 86

DISTRIBUTION

Aerial Cable, Vaults Serve Trade Areas

Florida P&L study shows loop or throwover system, or combination excells for up to 600 kva per business block.....p 96

GENERATION

A-Power Lubricants Cost 10% More

Special lubricants are needed in nuclear power plants as radiation increases viscosity of ordinary ones.....p 100

MEETING

NEMA Examines Price Squeeze

Profits are lagging other industries', manufacturers say; 'Electromation' is new 'Power-Up' wrinkle.....p 80

SUBSTATIONS

Steps Optimize Aluminum Buses

Determine conductor grade, shape, size; proper support; suitable method for joining and connecting.....p 92

Departments

Atomic Progress 83
Editorials 77
• Electrical Newsletter 21
Engineering Trends 24
From the Publisher..... 5
Heating & Cooling.....116
How To 105
• Management Newsletter 151
Manufacturers and Markets.....141
Meetings 88
Meetings Calendar 148
New Equipment 124
News About People.....158
News-Beat 85
Readers' Forum 162
Selling 114
Statistics 152
Washington Wire 84

INDEX TO ADVERTISERS.....166

Assure safe, "worry-free" splices by using tapes that are cable compounds . . .

In a safe, "worry-free" splice, the wall of electrical insulation around the connector is built up with a tape made with a cable insulation compound. The sheath, an extension of the cable's protective covering, is composed of a weather-, chemical- and abuse-resistant tape made with a cable sheathing compound. In other words, the splice . . . far from being a weak link in the cable . . . can be every bit as reliable.

Okonite splicing tapes are true cable compounds. The same ingredients are used in both. For example, Okolite Tape is made of the same basic compound as Okolite high voltage cable insulation. Okoprene Tape corresponds to the service-proved Okoprene cable sheath. Both of these materials—Okolite and Okoprene—have been specified by leading industrials for over 20 years.

Free samples of the Okonite Tapes are yours for the asking. Write to "Tape Dept., The Okonite Co., Passaic, N. J." and you'll promptly receive a trial kit containing a roll of Manson Friction Tape, Okonite Low Voltage Insulating Tape, Okolite High Voltage Insulating Tape, and Okoprene Sheathing Tape.

YOUR COMMUNITY'S LEADING ELECTRICAL WHOLESALER IS THE AUTHORIZED DISTRIBUTOR OF OKONITE QUALITY TAPES.

where there's electrical power . . . there's **OKONITE CABLE**

5'47

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. . . from the publisher

In addition to its weekly information service, Electrical World acts as a marketplace for the industry. Here's the eighth and final tip in our current series to help you get the most from your Electrical World subscription.

Tip No. 8 – Read the Ads

Looking for an economical way to boost heat-rate in that pre-war power station—as much as 5 to 6%? Want to know how to save money on service drop installations? Where to get a new high-speed recloser? Or how to carry more current on copper bus?

All the ideas and news in Electrical World aren't confined to the editorial columns. EW is a specialized business publication. And into it goes specialized advertising dealing with specialized products and services—designed to meet the specific problems of your job.

Many readers browze through the ads when they first thumb through the issue. Then they come back for closer reading later on. There's also an Advertisers Index in the back pages of each issue listing the company's name and the page numbers of its ads. Of course, the ads can't tell you everything you may want to know. So write to the manufacturer. You'll find his name and address at the bottom of his ad.

Fischer Black

ELECTRICAL WORLD

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NOW!...*Finally!*...Here's a method all wrapped up in

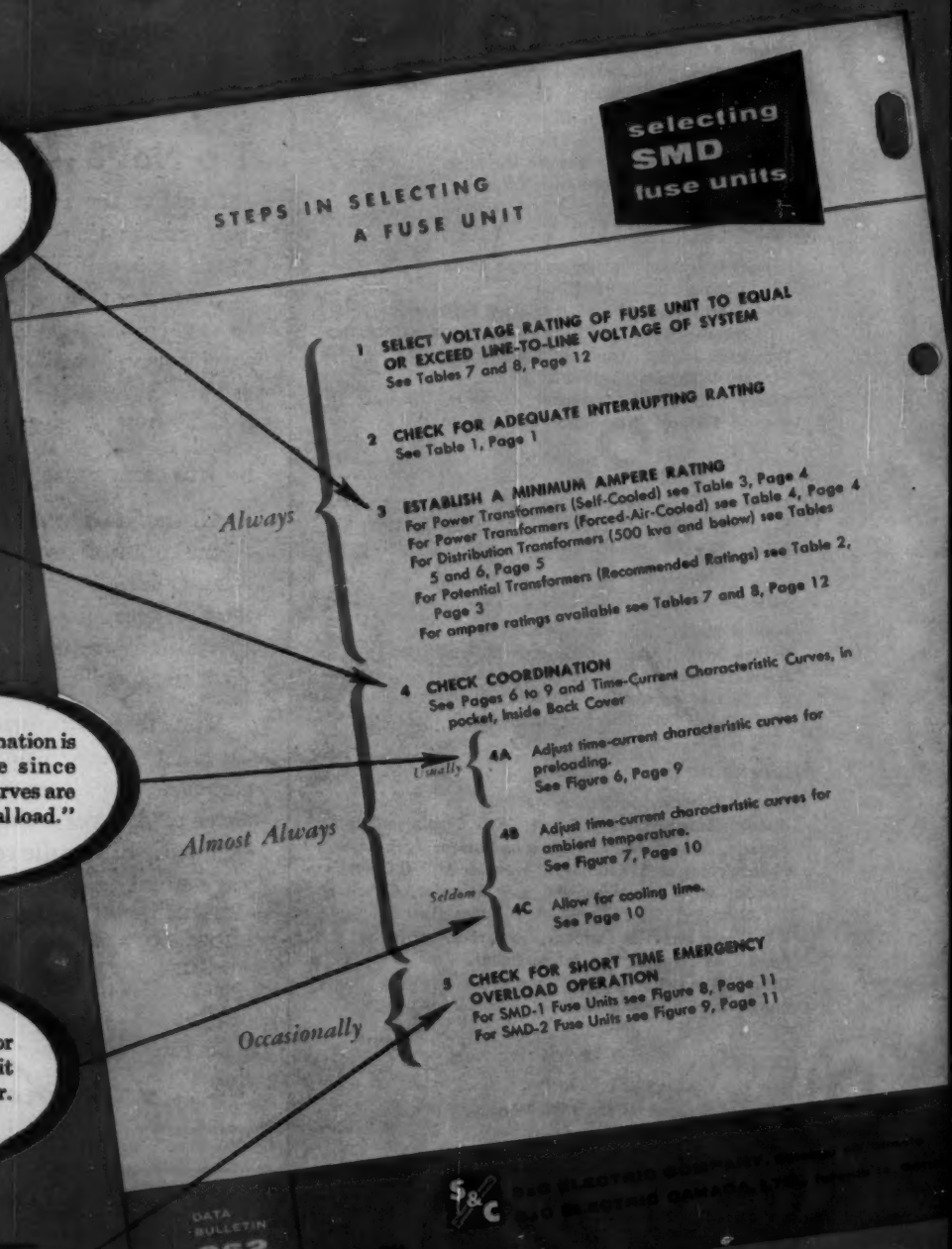
New ampere rating recommendations give maximum protection for transformers with precise allowances for short-time daily overloads.

Two methods of coordination are offered: Rule-of-thumb and Precision.

Preloading information is made available since Time-Current Curves are based on "no initial load."

How to compensate for successive short-circuit operations of the breaker.

Fuse overload capacity information is given here for the first time anywhere.

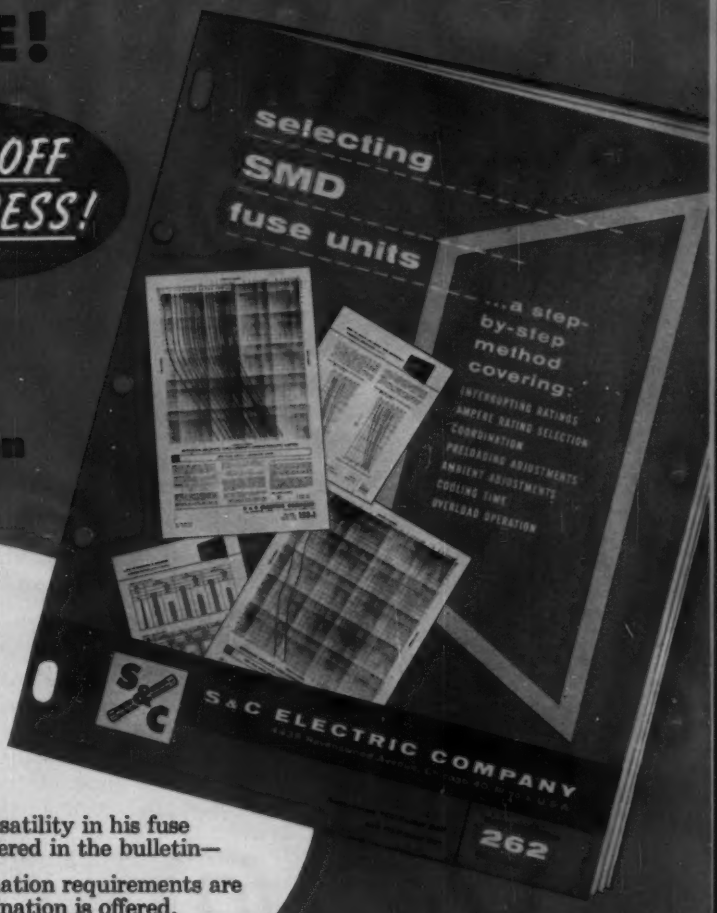

selecting SMD fuse units
STEPS IN SELECTING A FUSE UNIT
1 SELECT VOLTAGE RATING OF FUSE UNIT TO EQUAL OR EXCEED LINE-TO-LINE VOLTAGE OF SYSTEM
See Tables 7 and 8, Page 12
2 CHECK FOR ADEQUATE INTERRUPTING RATING
See Table 1, Page 1
Always
3 ESTABLISH A MINIMUM AMPERE RATING
For Power Transformers (Self-Cooled) see Table 3, Page 4
For Power Transformers (Forced-Air-Cooled) see Table 4, Page 4
For Distribution Transformers (500 kva and below) see Tables 5 and 6, Page 5
For Potential Transformers (Recommended Ratings) see Table 2, Page 3
For ampere ratings available see Tables 7 and 8, Page 12
4 CHECK COORDINATION
See Pages 6 to 9 and Time-Current Characteristic Curves, in pocket, Inside Back Cover
Usually
4A Adjust time-current characteristic curves for preloading.
See Figure 6, Page 9
Almost Always
4B Adjust time-current characteristic curves for ambient temperature.
See Figure 7, Page 10
Seldom
4C Allow for cooling time.
See Page 10
Occasionally
5 CHECK FOR SHORT TIME EMERGENCY OVERLOAD OPERATION
For SMD-1 Fuse Units see Figure 8, Page 11
For SMD-2 Fuse Units see Figure 9, Page 11
DATA BULLETIN
262

S&C

for power fuse coordination
ONE PACKAGE!

JUST OFF THE PRESS!

it frees you from hocus-pocus; it gives you more fuse protection



The key to this method is a step-by-step sequence as shown at the left (the first inside page of the new Data Bulletin 262).

For each step, all the necessary data is at your finger tips. You have a choice of two methods—

for the man who wants more range and versatility in his fuse coordination, a "precision" technique is offered in the bulletin—

for the man-on-the-go, whose fuse coordination requirements are not so rigorous, the "rule-of-thumb" coordination is offered.

Write today for your copy of this 12-page-plus-cover Data Bulletin 262, with necessary TCC curves.

S & C Power Fuse Type SMD. Illustrated below: vertical style 69 kv.

Specialists in High-Voltage Circuit Interruption Since 1910

S&C ELECTRIC COMPANY

In Canada: S & C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

An example of Allis-Chalmers

550-BIL Transformer for 161-kv system raises efficiency, cuts weight, size

Here's dramatic proof of progress!

Close manufacturing control is illustrated by this A-C designed machine used to place precisely the tens of thousands of spacers for directing oil flow.

Valuable experience was gained from building and using this 600-kv transformer for test and research.

● A few years ago a 46,667-kva transformer with a combination of reduced insulation, corona-free design, high short-circuit strength and quick-break tap changer would have been the sensation of the industry.

Today, as a result of design research and experience, production of transformers like this is a reality.

Insulation for this 161-kv transformer would normally be used for 115 and 138-kv units. This reduction of two steps is the result of coordination of modern "corona-free" insulation and improved system overvoltage protection. It makes possible substantial savings in weight, size and cost while increasing efficiency without sacrificing reliability.

Concentrated research on reduced insulation was begun by Allis-Chalmers in the 1930's. After the interruption of World War II, new test methods and manufacturing controls were developed to take advantage of this advanced engineering knowledge. As a result, today's A-C transformer is constructed on a triangle of quality: experience . . . design . . . and close manufacturing control.

For details on the engineering of this interesting design, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

leadership in transformers

550-BIL Transformer being shipped to Northern States Power Company.

Pioneer Service & Engineering Co.

A-C ALLIS-CHALMERS

A-5510

You get HIGHER CONDUCTIVITY with BLACKBURN SERVICE ENTRANCE SLEEVES

because Blackburn... and Blackburn alone... provides

GREATER CONTACT AREA where needed

Hole Depth Increases With Size of Conductor... thereby providing more contact area for the conductors being connected.

COLOR CODE	WIRE SIZE ACSR	WIRE SIZE AWG	HOLE DEPTH IN INCHES
Brown	–	8 sol — 10 str	.820
Green	–	6 sol — 8 str	.840
Blue	6	4 sol — 6 str	.860
Orange	4	2 sol — 4 str	.925
Red	2	1 sol — 2 str	1.010
Yellow	1/o	1/o str	1.185

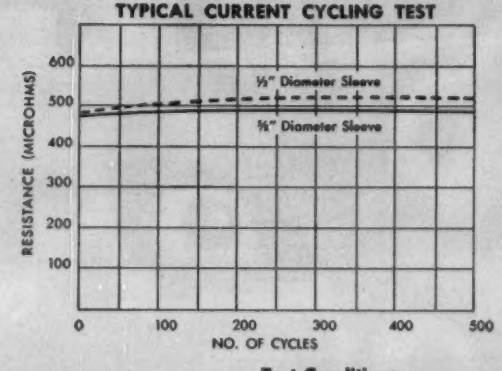
The center stop in a Blackburn Sleeve is a solid barrier that assures proper distribution of the inhibitor around the conductors.

FIRST! Printed (not indented) permanent COLOR CODING *is easier to read*—makes size identification positive and quick.

FIRST! Aluminum Sensitized Tape seals the Blackburn Sleeve's ends. Easy to puncture... and, if a particle of the seal is pushed into the chamber, it is conductive.

FIRST! Each Blackburn Sleeve contains the superior Blackburn inhibitor, Contax, *in measured amount.* Won't squirt out on glove or in face.

Conductivity of Connection PROVED GREATER Than Equivalent Length of The Conductors Being Connected.



A series of typical current cycling tests were conducted with both ½" x ⅜" diameter BLACKBURN Sleeves. Note the lower resistance of Blackburn Sleeves as compared to the equivalent length of cable without any sleeve.

Test Conditions

Wire: 2 ACSR to 4 stranded copper
Current: 190 Amperes
Cycle: 2 Hrs. "On" 1 Hr. "Off"
Length of Connection: 24 inches
Curves represent an average of five tests
Resistance of equivalent length of wire: 527 Microhms

LIVE BETTER ELECTRICALLY

JASPER BLACKBURN CORPORATION, 1525 Woodson Rd., St. Louis 14, Mo. • WYdown 3-9430

Mallory Contact Design Service Saved Nearly 50% For an Electrical Equipment Manufacturer

A large electrical equipment manufacturer required heavy duty contacts for a new product design. The original specifications and tolerances indicated this contact should be made from oversize copper stock—formed—inserts brazed in place—and the complete assembly straddle-milled to finished dimensions.

Mallory Contact Design Service proposed an alternate design. They developed a method to use smaller stock—braze the contact inserts—grind to required thickness—then form the contact shape.

The equipment manufacturer benefitted because the cost of machining operations and of oversize stock were eliminated. The cold working of the contact piece resulted in extra strength, giving it a longer life potential. Actual cash savings of nearly 50% were passed on to the customer —thanks to Mallory's contact design engineering.

FIVE *MALLORY* KEYS TO ECONOMY THROUGH CONTACT ENGINEERING

1. The most effective contact material from the extensive line developed by Mallory. More economical alloys often can satisfy *actual* service conditions.
2. The most economical contact design . . . for your purchasing, production and product needs.
3. The most economical backing material . . . from a group of Mallory alloys developed for this use.
4. The most economical backing member design in relation to contact and product design requirements.
5. The most economical method of assembling contact and backing member.

By coordinating *all* these important elements of contact design, Mallory can help you put into effect a long-range plan for cutting contact cost and assuring peak performance.

Write or call Mallory for a consultation.

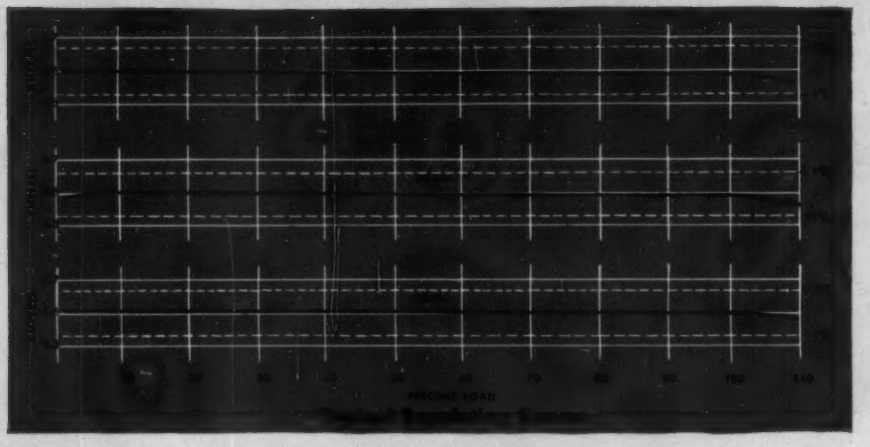
Serving Industry with These Products:

Electromechanical — Resistors • Switches • Tuning Devices • Vibrators
Electrochemical — Capacitors • Mercury and Zinc-Carbon Batteries
Metallurgical — Contacts • Special Metals • Welding Materials

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Specify MOLONEY CONSTANT . .

FOR CURVES LIKE THIS...

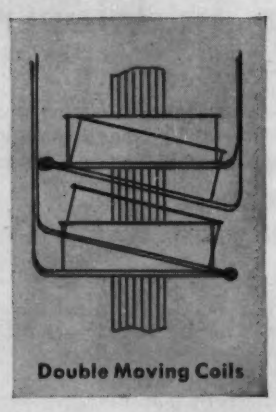


Moloney Offers A Complete Line Of Constant Current Transformers Which Provides Better Operating Performance For Your Series Street Or Highway Lighting Circuits.

Better Regulation . . . due to superior electrical design, plus Moloney's exclusive double-moving-coil construction makes Moloney Constant Current Transformers the most practical buy. A complete range of primary voltage and frequencies and secondary current ratings or multiple secondary ratings, permits a wide choice for *your* particular requirements.

Exclusive mechanical and electrical features make Moloney Constant Current Transformers the accepted choice for greater efficiency, better regulation and longer operating life.

Available in standard and special ratings conforming to ASA Standards, for Pole or Platform mounting, subway or station installation, with or without capacitors, and in completely self-protected, packaged units for fully automatic operation.



Double Moving Coils

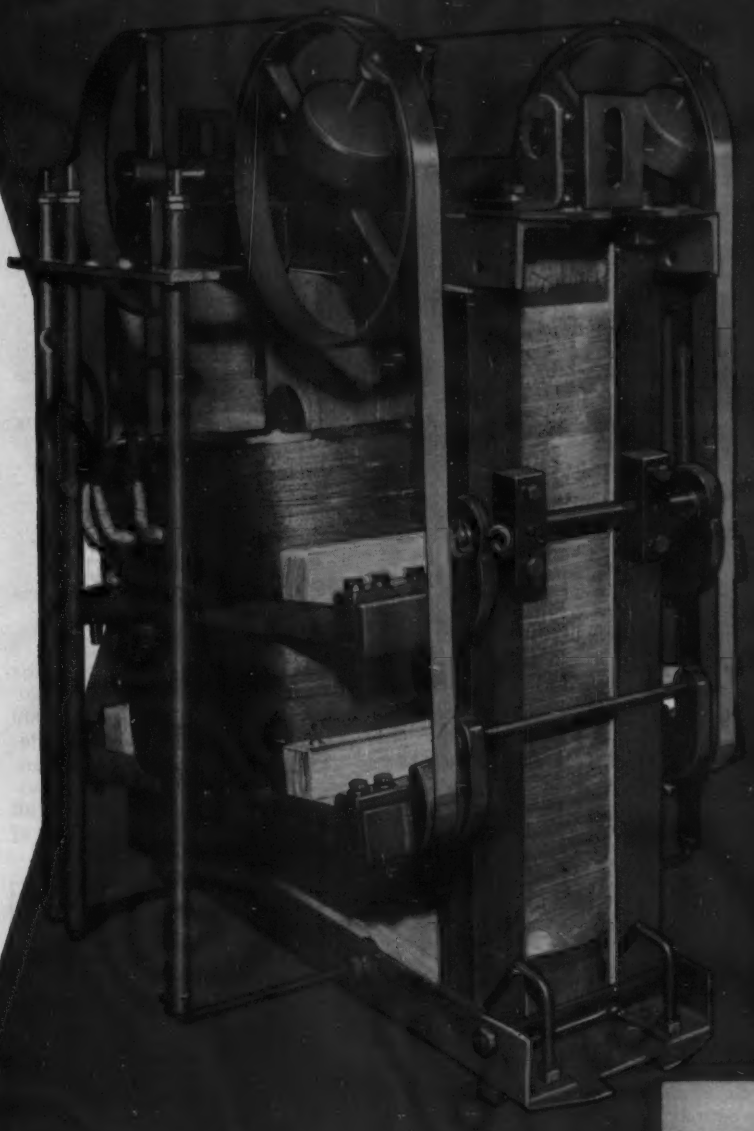
MEET IS

MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 30, MO. AND TORONTO, ONT., CANADA

. . CURRENT TRANSFORMERS

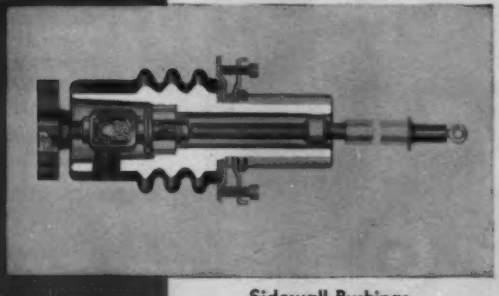


External Adjusting Handle Mechanism (Patent applied for)

Flexible Coil Leads

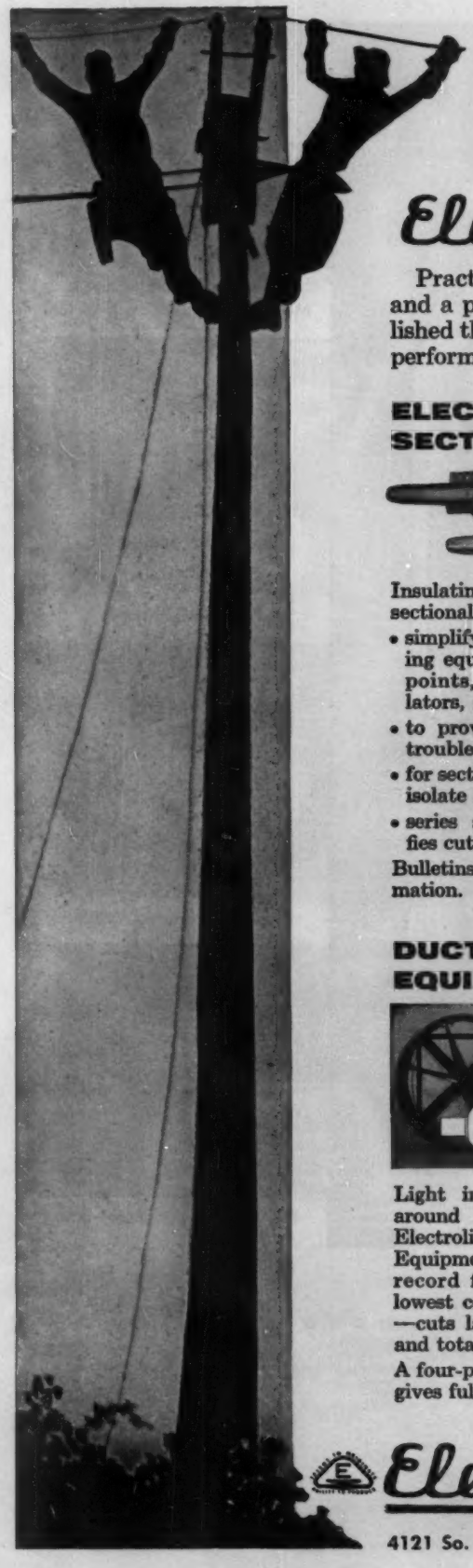
Counter Balancing Weights

Ball Bearings At Fulcrum Arm



Sidewall Bushings

MOLONEY ELECTRIC



for the largest number of line applications, at the lowest possible cost . . .

Electroline Products

Practical experience designed these Electroline Products; and a practical habit of keeping close tab on costs has established them as first in the field—for top quality and economical performance.

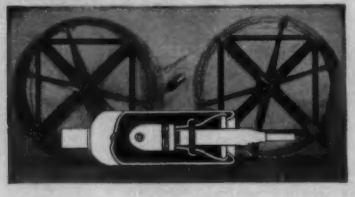
ELECTROLINE SECTIONALIZERS

Insulating automatic line splice sectionalizers:

- simplify cutting-in of regulating equipment—disconnecting points, fuses, voltage regulators, series capacitors, etc.
- to provide points to test for trouble
- for sectionalizing networks—to isolate and test area in trouble
- series street lighting—simplifies cutting-in series lamps

Bulletins contain complete information.

DUCT-RODDING EQUIPMENT



Light in weight, feeds easily around bends, easy to handle. Electroline Steel Duct-Rodding Equipment has an extraordinary record for high efficiency at lowest cost. A big money-saver—cuts labor cost, original cost and total investment.

A four-page illustrated brochure gives full information.

AUTOMATIC LINE SPLICES

It is well said of these simple, rugged units—"They go on in no time; they hang on for all time." Easy to install—and their mechanical strength exceeds the rated breaking strength of the conductors. Ideal for restoring service.

AUTOMATIC DEAD-ENDS

In a typical "torture" test for strength, gripping and vibration damping features, 100,125,000 recorded vibrations did not develop any sign of failure of conductor in these rugged dependable Dead-Ends. Engineers call it equivalent to 50 years of ordinary service.

Electroline Service-Drop Automatic Dead End. The "3800" Series for holding pre-assembled service cable using a bare neutral conductor as the messenger.

The method of gripping the bare neutral employed by this ELECTROLINE Anchorage eliminates the danger of short circuiting the phase wires so common with the use of concentric cable clamps.

ELECTROLINE Service-Drop Anchor Bracket. The "4000" Series for securely supporting the cable at any angle.

Electroline Company

4121 So. LaSalle St., Chicago 9, Ill. *In Canada:* POWERLITE DEVICES, LTD., TORONTO

POWERS *American*

SERIES LM-4

"Load-Master"

HYDRAULIC CRANE

Saves time and manpower because it speeds up loading and unloading jobs... handles work normally requiring several specially-equipped vehicles.

Load-Master lifts a 4000 lb. load with ease... moves it safely and quickly under the most adverse job conditions. Power is derived from a heavy-duty hydraulic-pump driven by the truck engine. Controls are located in a position which gives operator full view of the crane at all times.

Operator has absolute control of load at all times. The hydraulic system requires intentional movement of control levers before load position can be changed... and the load cannot drop if the truck engine stalls.

OPERATING FEATURES: Telescopic-type hydraulic boom can be spotted at any point from horizontal position to an 85° angle of elevation; hydraulically-powered mast will turn 360° in either direction; specially-designed winch, driven by a hydraulic motor, is grooved to wind cable evenly; hydraulic outriggers, with swivel-mounted foot plates, furnish extra side stability.

Load-Master is ideally suited for use with the Powers-American Series 300 Body shown above. It can also be furnished with bodies of other types... or shipped for mounting in your shop or local garage.

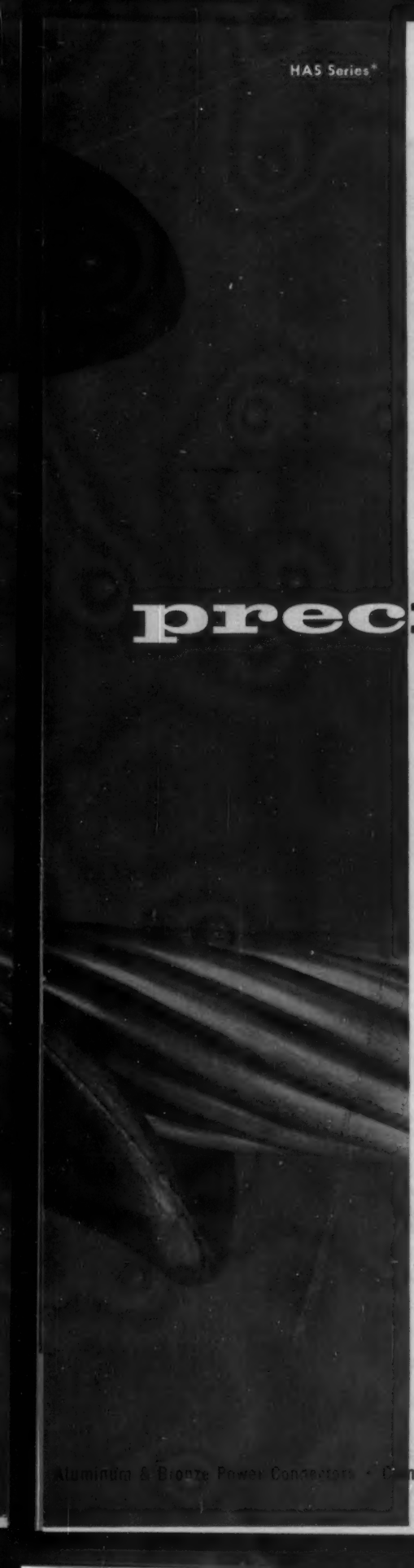
Price information and descriptive literature will be sent upon request.

Load-Master can be used for setting poles up to 45' in length. It requires only 20" of mounting space behind the truck cab. Boom extensions to 22' can be furnished.

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY
ST. LOUIS 15, MO.

625 CEDAR STREET
BERKELEY 10, CALIF.



precision...

Power loss is practically eliminated with Anderson's Suspension Clamps. They are precision engineered to permit dual use . . . suspension as well as angle pull off. Specific features were engineered to allow widest range of conductor sags. Light weight construction reduces conductor damage.

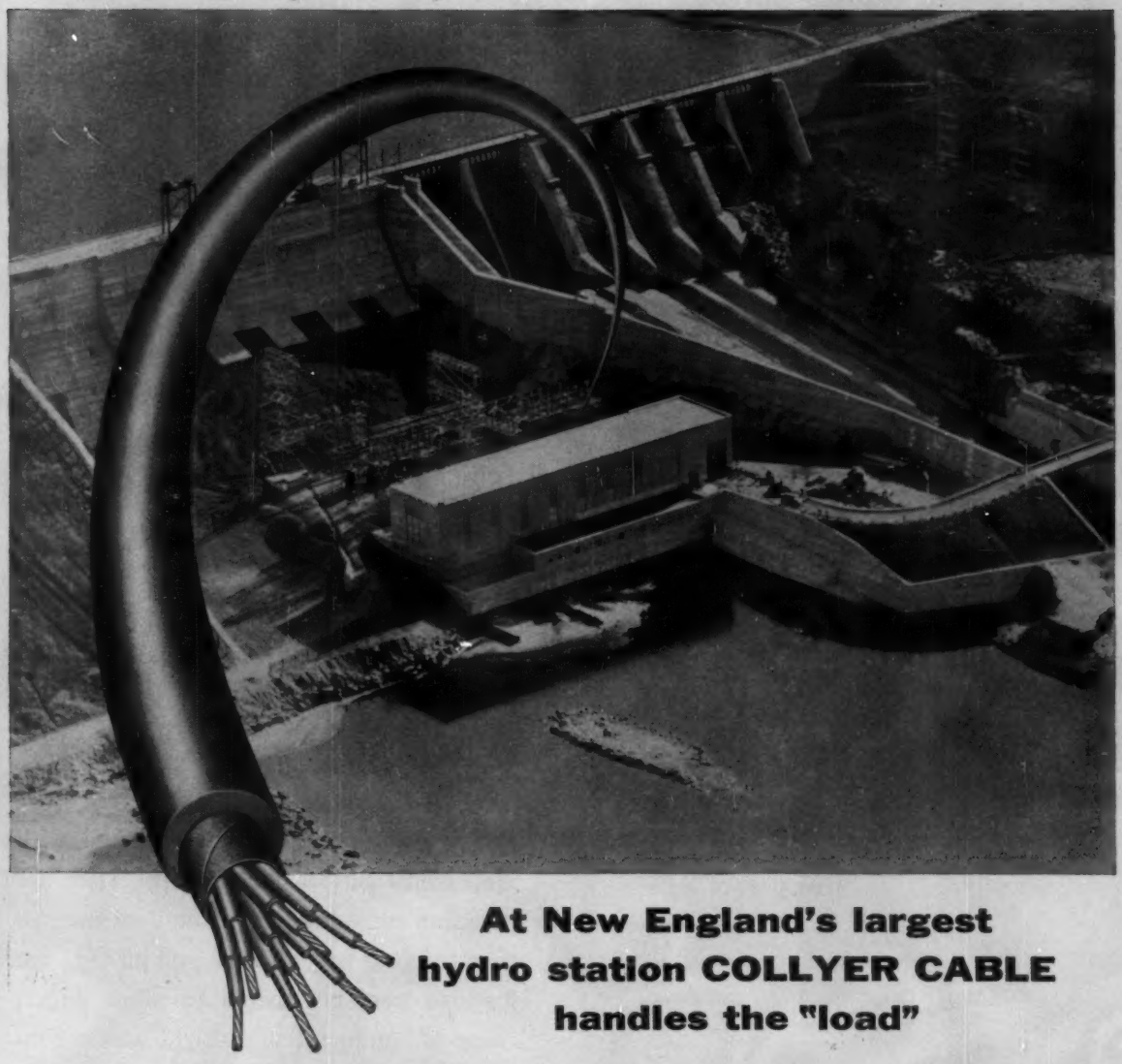
ANDERSON ELECTRIC CORPORATION
Birmingham 1, Alabama

ANDERSON ELECTRIC

*Sold through Insulator Manufacturers.
Export Agent: International Standard Electric Corp.

Aluminum & Bronze Power Connectors • Clamps • Fittings • Accessories for SUBSTATIONS • TRANSMISSION • DISTRIBUTION

Another call for Collyer . . .



At New England's largest hydro station COLLYER CABLE handles the "load"

Big enough to supply the combined electrical needs of two medium-sized cities, the New England Electric System's new Samuel C. Moore Hydroelectric Station at Littleton, New Hampshire, now adds its 190,000 kilowatt capacity to New England's growing power pool.

To supervise, control and direct the giant load generated by this $41,000,000 plant, New England Electric engineers specified the installation of Collyer Type RR Station Control, Supervisory and Motor Lead Cables throughout the entire project. Their choice is typical of the choice made by engineers everywhere. More and more, where the call is for cable that meets highest construction and serviceability standards, the call is for Collyer. **Learn more** about the advantages of specifying Collyer Cable for all types of municipal or private installation. Write now for further information relating to your specific requirements. **Collyer Insulated Wire Co., 245 Roosevelt Ave., Pawtucket, Rhode Island.**

LIVE BETTER ELECTRICALLY

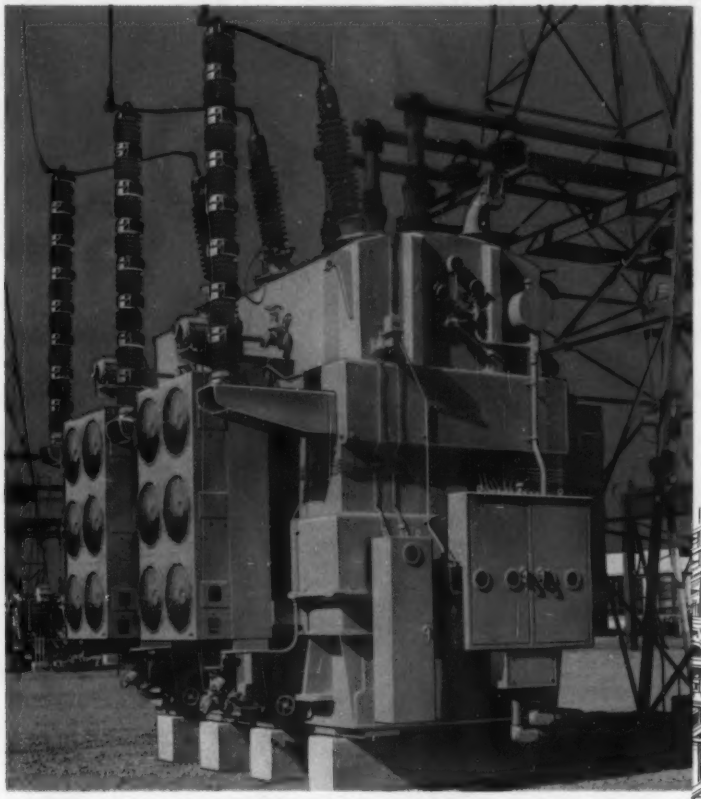
Collyer

Power Cables • Control Cables
Switchboard Wires • Service Cables
Series Lighting Cables • Building Wires

140,000 Kva Oasis of Power!

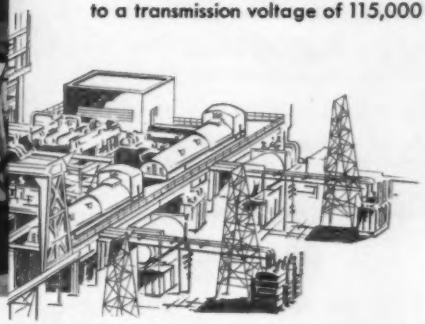
For Desert Duty at Saguaro Power Plant,

Arizona Public Service Chose PENNSYLVANIA!



ON GENERATING UNIT NO. 2

at Saguaro Steam Electric Generating Station, a Pennsylvania 140,000-kva "Contour Design" Power Transformer steps up the generated voltage of 14,700Δ volts to a transmission voltage of 115,000 volts.



The colorful desert location for Saguaro Station—30 miles north of Tucson—was selected by Arizona Public Service Company because of its proximity to highways, railroads, natural gas, and a large underground water basin. Equally important was the effective balance of the state's power generation and transmission facilities permitted by this location.

Extreme care also was taken in selecting the equipment for generating and transmitting up to 200,000 kilowatts—as much power as the entire state of Arizona used in 1942. On unit no. 2, the main step-up transformer, a 140,000-kva, 115-kv Pennsylvania Power Transformer, easily satisfies the utility's rigorous requirements regarding quality and efficiency. In addition, the compact "Contour Design" afforded considerable savings in installation time and costs—for it permitted the transformer to be shipped upright and completely assembled, except for bushings and the four oil-to-air heat exchangers.

McGRAW EDISON

For similar economy as well as proved performance, it will pay you to check Pennsylvania regarding *your* next power transformer installation. For more details or a quotation, contact Pennsylvania Transformer Division, McGraw-Edison Company, Box 330, Canonsburg, Pennsylvania.

PENNSYLVANIA TRANSFORMERS — pt

PENNSYLVANIA POWER TRANSFORMERS

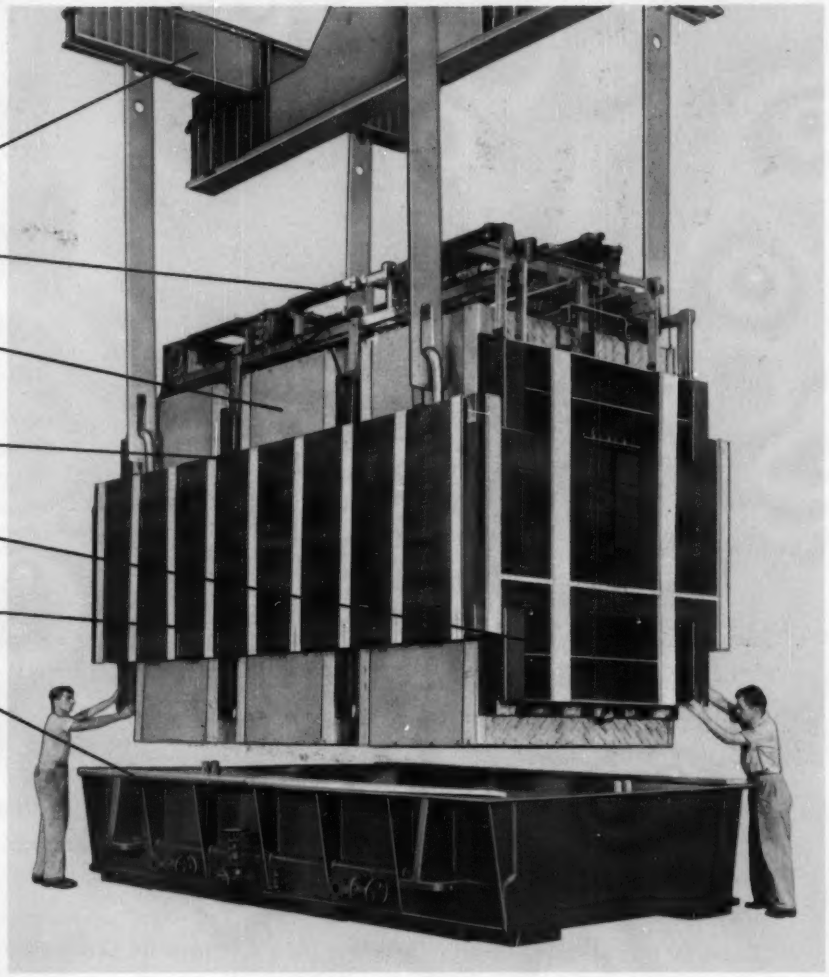
See other side for design details . . .

140,000 Kva PENNSYLVANIA

CONTOUR DESIGN POWER TRANSFORMER

IN MAIN STEP-UP SERVICE AT SAGUARO . . .

ARIZONA PUBLIC SERVICE COMPANY'S NEWEST, LARGEST POWER PLANT



Core-and-coil assembly being lowered into bottom tank section by Pennsylvania's 165-ton crane.

Tap changer located above core and coils, where it is accessible through manholes for inspection and maintenance.

Vertical cooling ducts in coils permit free flow of oil through coils for most efficient cooling.

Core and coils clamped together with heavy steel frames. Core-and-coil unit can be handled separately as complete subassembly.

Heavy box sections form part of core frame and clamp coils against short circuit forces.

Core cooled by both vertical and horizontal ducts.

Core-and-coil assembly rests on bottom section of Contour Design tank.

140,000 kva, three phase, 60 cycles, 55°C. temperature rise. Forced-oil, forced-air-cooled. High voltage: 115,000 Grd. Y/66,400 volts. Low voltage: 14,700Δ volts.

McGRAW EDISON

PENNSYLVANIA TRANSFORMERS

Pennsylvania has the Facilities and the Capability to meet the Largest Power Transformer Requirements

- A large, expertly-staffed engineering department with long experience in power transformer design—both core form and shell form.
- The ability to design and construct scale models for proving design characteristics.
- A modernly equipped plant capable of producing and testing the highest rated units contemplated by the industry today.
- Handling and loading facilities that permit full utilization of manufacturing, shipping and installation economies.

PENNSYLVANIA TRANSFORMER DIVISION

McGraw-Edison Company

CANONSBURG, PENNSYLVANIA Greater Pittsburgh District

See other side for installation view . . .

NEWS-SCOPE

FUTURE NEWS ▶ **Complete revision of our atom policy** may be the result of forthcoming meeting on Dec. 3-5 in Washington, D. C., between industry representatives and the AEC (See also p 83).

The shortage of engineers which seemed to be ending is predicted to continue indefinitely, due to the growing demands for scientific personnel in research activities and government service.

Current delay in placing orders for generating equipment will create critical shortages two years hence.

LATE NEWS ▶ **As hearings close, unions lose two rounds in their fight against** Power Reactor Development Co's proposed nuclear plant in Michigan. In one action, an AEC commissioner rejected a union request to disqualify Chairman Lewis Strauss on grounds of "personal bias". In another, the AEC staff denied that the auto, electrical, and paper unions hadn't received a fair hearing last summer.

Engineers launch campaign to raise $5 million toward the $10-million United Engineering Center, New York City. The 20-story tower will be headquarters for 250,000 engineers from 16 national societies.

Britain gets its first export order for an operational atomic power station from Italy. The 200-Mw station with one reactor is being supplied by Nuclear Power Plant Co for $56 million. Slated for construction in northern Italy, it will be of the Calder Hall type.

American Machine & Foundry Co is curtailing its work in the power reactor field, says Chairman Morehead Patterson. AMF will continue in the research reactor field but will go "gingerly" in the power field. "We don't have $50 million to lose" at this time, he said.

Douglas County PUD will go ahead with Wells Dam construction, despite recent withdrawal by Kaiser Aluminum & Chemical as a partner in the development. Kaiser reportedly found that high power and transportation costs would put unit cost of production too high for an aluminum facility connected with the project.

Louisville Gas & Electric tells PSC it is raising rates immediately. The hike will mean an annual increase of $2,168,631 for electricity and $1,530,606 for gas users. LG&E's action is allowed under statutes which place a five-month limit on cases pending before PSC. Subsequent PSC action can either approve or disapprove.

Congratulations . . . Four new VP's at Detroit Edison are Arthur Griswold, who will direct industrial and public information; Donald F. Kigar, union relations; Sylvester F. Leahy, employee relations; and Chester F. Ogden, purchases and real estate . . . At Boston Edison, George A. Orrok rises to VP-engineering and construction and Charles F. Avila to VP-assistant general manager . . . Andrew E. Burnett will become operating manager of Southern Electric Generating on Dec. 2.

ELECTRICAL WEEK

A TWO-MINUTE

EVENTS ▸ **Co-ops may bring anti-trust suit against private power** companies, their organizations, and public relations firms. A regional NRECA meeting adopted resolution calling for exploration of this legal harassment (p 78) . . . New Department of Defense program is aimed at buying up power company distribution facilities serving Wherry housing projects; 50,000 meters to be affected (p 79).

WASHINGTON ▸ **A joint subcommittee is scrutinizing Uncle Sam's policy** of aiding financially in the development of natural resources. The ten-day hearings, already under way, promise to become a major evaluation of federal aid (p 84).

ATOMIC PROGRESS ▸ **New radiation-resistant lubricants have been developed** for atomic applications, an oil company reports. They can be handled exactly the same way as ordinary oils and greases when used on non-nuclear machines. But they cost about 10% more (p 100).

MEETINGS ▸ **"Early Bird" economic loading computer saves Southern Co** $400,000 a year, twice original estimate (p 88) . . . New relaying philosophy developed for Philadelphia Electric's Eddystone Station to prevent system instability if fault threatens whole plant (p 88).

Look out for the new appliance owner who has not been shown how to use her new appliance properly. She can become a bearcat in spreading unflattering remarks about it (p 89).

Progressive education is tramping hard upon engineering education (p 90) . . . Utility employees must push electric living (p 91) . . . Higher equipment prices and more "power up" must come to help offset growing labor shortage. By 1965 industry should use 585 billion kwhr, to produce 40% more than today (p 80).

DISTRIBUTION ▸ **For improved reliability and a trim appearance,** consider serving small business areas with aerial cables which feed transformers in vaults. Florida P&L ran a study on this little-exploited type of distribution and found that such systems would work for densities up to 600 kva per block. FP&L's study examined cost, reliability, and adaptability of four variations on the idea: Simple radial, loop, primary throwover, and secondary network. Costs of radial, loop, and throwover systems are not widely separated, but high unit costs of transformer stations favors larger secondary mains and fewer vaults. The high-cost secondary network offers maximum reliability, but all four promise advantages (p 96).

If you're planning to use aluminum buses in a future substation, check these tips given by ALCOA's design expert Don Sandall: You'll get best results economically if the bus design integrates electrical and

mechanical loadings, and if aluminum members are properly joined. First determine load and short-circuit current the bus must handle, then pick a bus shape to carry the load. To choose the proper metal, consider (in addition to installed cost) these parameters: Voltage drop and power loss; current-carrying capacity; ice and wind loads, and aeolian vibration; corrosion, corona, and radio interference (p 92).

INDUSTRIAL ▶ **Transformer manufacturer now has concrete proof** of the value of good lighting. After installing a new fluorescent system that yields 115 ft-c in a manufacturing area, his production jumped 10% and, furthermore, rejects dropped 10% (p 120).

SELLING ▶ **Detroit has tried out high-frequency fluorescent street lights** and reportedly likes its preliminary findings. They include: A 75% reduction in ballast weight; a 13-18% increase in light, using special series ballasts, and an overall increase in lumen output by 10% in summer and 20-23% in winter. Power goes into magnetic frequency multipliers at 60 cps, and comes out at 360 cps with a p-f correction thrown in for good measure (p 114).

ECONOMICS ▶ **Cheap nuclear power is not developing as fast as expected.** There is a notable growth of proposed atom projects, but a notable decline in contracts actually awarded. Nearly all contracts awarded so far this year have been for research—not construction (p 151).

FINANCE ▶ **Federal Reserve Board reduces rediscount rate** from 3½ to 3% in a surprise reversal that may be designed to recapture slipping business confidence (p 153).

MANAGEMENT ▶ **Don't be afraid of retirement. All you need is** advance planning. This is what Con Edison found out after moving tentatively into retirement counseling. Employees reacted so favorably that the company decided that such "tampering" with personal affairs of its employees was well worth the risk (p 86).

PEOPLE ▶ **Mississippi Power Co** names Harllee Branch, Jr, vice-president and member of the board; he fills the spot held by the late Eugene A. Yates . . . Florida Power promotes Richard E. Raymond to superintendent of T&D . . . Puget Sound P&L dubs Dave Knight supervisor of system operations (p 158).

NEW EQUIPMENT ▶ **Current transformers, molded of an epoxy resin,** are for use with ammeters and wattmeters in tight-fitting industrial spaces (p 124).

MANUFACTURERS ▶ **Westinghouse introduces a steel that magnetizes easily** in four directions . . . General Electric announces new Class F insulating varnish that bucks temperatures of 155C (p 141).

ENGINEERING TRENDS

Maintenance costs must be based on records for correct inclusion in the incremental cost of power generation. Maintenance is a small item compared with fuel cost and is best included as a function of the fuel cost.

"Electric Shock" treatment has almost tripled the yield of tomato plants according to a recent article in the ELECTRICAL JOURNAL. The method used consists of passing a high-frequency current in a series of shocks through the soil from plates fixed to the top and bottom of pots.

Standardization of both analog and digital computers is being considered by the British Radio Communications and Electronic Engineering Association. Under study by the group are nomenclature, tape specifications, and input keyboard and output devices.

Semi-outdoor construction for boilers, an accepted power plant practice in the United States, has been used in the newly constructed Ince power plant in North Wales. Station consists of four 60-Mw units.

Chances of reducing nuclear power plant containment costs to less than 3 or 4% of total plant costs do not appear probable with present technology.

By 1965-70 recycling of plutonium fuel will be well established according to Sir John Cockroft of Britain's Atomic Energy Authority. The plutonium may be recycled with thorium as a fertile material to lead into the thorium-fuel cycle which is likely to have better nuclear characteristics than uranium-fuel cycles for thermal reactors.

Transformer noise level at a residence 100 ft away can be cut 12 to 15 db by a masonry barrier extending upward to 2 or 3 ft above the highest part of the tank, or conservator if used. Adding wings to make barrier L or U shaped may enlarge the arc of quieting but contributes little to the cut in noise level. But adding fourth wall to completely surround the transformer limits barrier's effect to about 10 db. Shrubbery barriers, even where very dense, cut noise level only a few db.

FROM EDITORS IN THE FIELD

Field testing of A-base thermal demand meters will soon be adopted by a Southeastern utility.

First multi-circuit (four) wire-line carrier is operating successfully for long distances over insulated overhead ground wires of a 110-kv line. Cost of the system to Alabama Power Co was $25 per mile per channel.

CONTAMINATION

Effectively controlled by new THOREX Dynagap high voltage lightning arresters

A new and effective measure to combat contamination is offered in Thorex Dynagap high voltage lightning arresters. Leakage currents stay on the outside where they are harmless.

These new arresters use functionally one-piece housings. There are no stacking units and, therefore, no stacking unit connections. Surface leakage currents cannot enter the sensitive internal arrester circuit at intermediate points and, therefore, cannot have the effect of shorting-out one or more units. This has been a major cause of high voltage arrester failures and is now completely eliminated in modern Thorex Dynagap design.

Since industrial contamination is either present, or certainly likely, in most principal station locations today, be sure your arrester protection carries the added insurance of immunity to this common operating problem.

— and when you install new Thorex Dynagap station class MPR arresters, you will get other unique improvements: superior protective qualities and unheard-of surge current durability — all at an attractively low installed cost.

OHIO BRASS COMPANY, MANSFIELD, OHIO

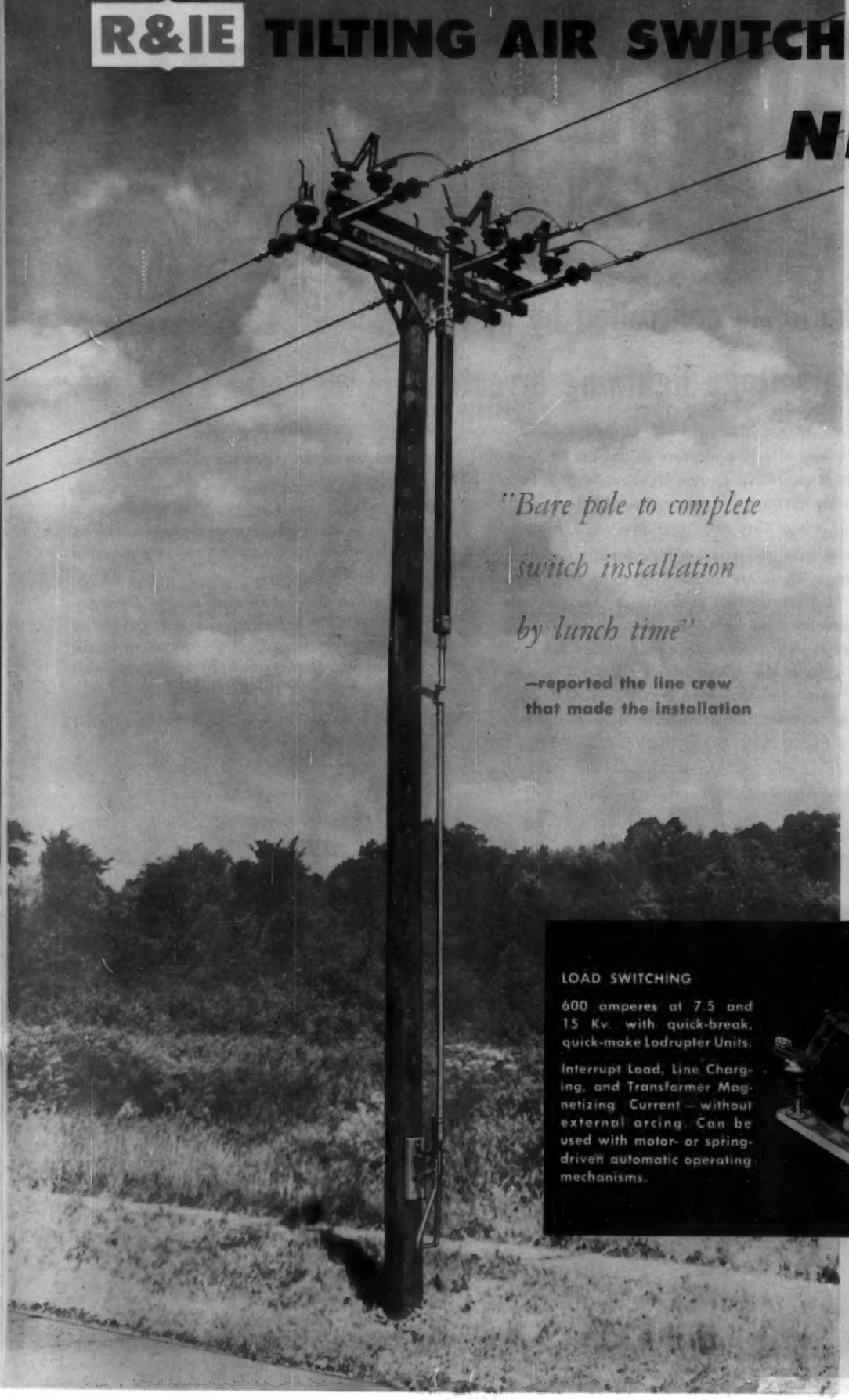
Ohio Brass

Here is laboratory proof of the remarkable contamination-resistance of new Thorex Dynagap high voltage arresters. This model for 345-kv service was energized at 276 kv — full line-to-ground rating, and approximately 33 per cent above normal expectancy. Wetting was applied intermittently, and consisted of concentrated salt solution in a wetting agent. This far exceeds standard wet test specifications and is more severe than any known natural surface contamination. The test continued for 12 minutes. In this time, surface leakage was so severe that considerable steam was produced, as can be observed on the upper-left portion of the housing. The entire arrester was "alive" with inter-petticoat discharges, and full open flashover frequently occurred, as the picture shows. The arrester protective circuit did not react in any way to this test, which would be destructive to any multi-unit design long before flashover could be reached. The metal collar near the center of the arrester is entirely on the outer porcelain surface and has no connection with internal parts, thus producing a functionally one-piece housing.

4783-H

R&IE TILTING AIR SWITCHES

NEW..



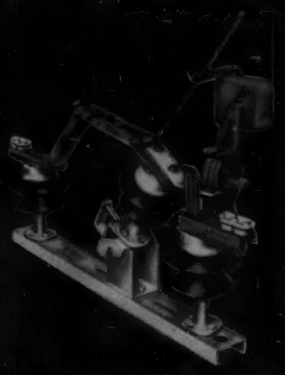
"Bare pole to complete switch installation by lunch time"

—reported the line crew that made the installation

LOAD SWITCHING

600 amperes at 7.5 and 15 Kv. with quick-break, quick-make Ladrupter Units.

Interrupt Load, Line Charging, and Transformer Magnetizing Current — without external arcing. Can be used with motor- or spring-driven automatic operating mechanisms.



type **ST...** *Shuntless, Tilting Insulator*

EXCEED EVERY NEMA STANDARD FOR AIR SWITCHES.

•

CONVERTIBLE TO "ARCLESS" LOAD SWITCHING.

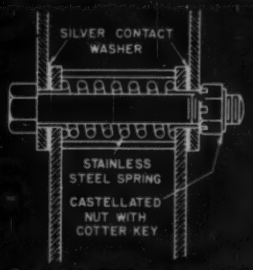
•

ALL LIVE PARTS OF HARD DRAWN OR BERYLLIUM COPPER. NO FLEXIBLE BRAID.

•

IN STOCK WITH STANDARD MECHANISM READY FOR SHIPMENT—OR, CUSTOM ENGINEERED TO SYSTEM STANDARDS OR SPECIAL APPLICATIONS.

VOLTAGE	AMPERES		
	Continuous	Momentary	Interrupting (With Lodrupter)
7,500	200 400 600	20M 40M	600 600 600
15,000	200 400 600	20M 40M	600 600 600
23,000	200 400 600	20M 40M	
34,500	200 400 600	20M 40M	



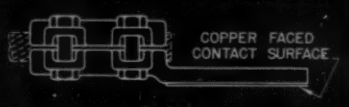
SHUNTLESS—annular, pressure-loaded, silver-to-copper hinge contacts eliminate braided flex connection.

STANDARD INTERPHASE—wood or steel. Wood shaft can be standard cross-arm—3 to 4, by 4 to 5 inches.

RATING CONVERSION—200, 400, 600 Amp. Jaw fingers easily added to increase rating.

TLD

Tinned copper—#8 to 1000 MCM



ACFC

Aluminum—#4 to 900 MCM A1.
#4 to 715 MCM ACSR.

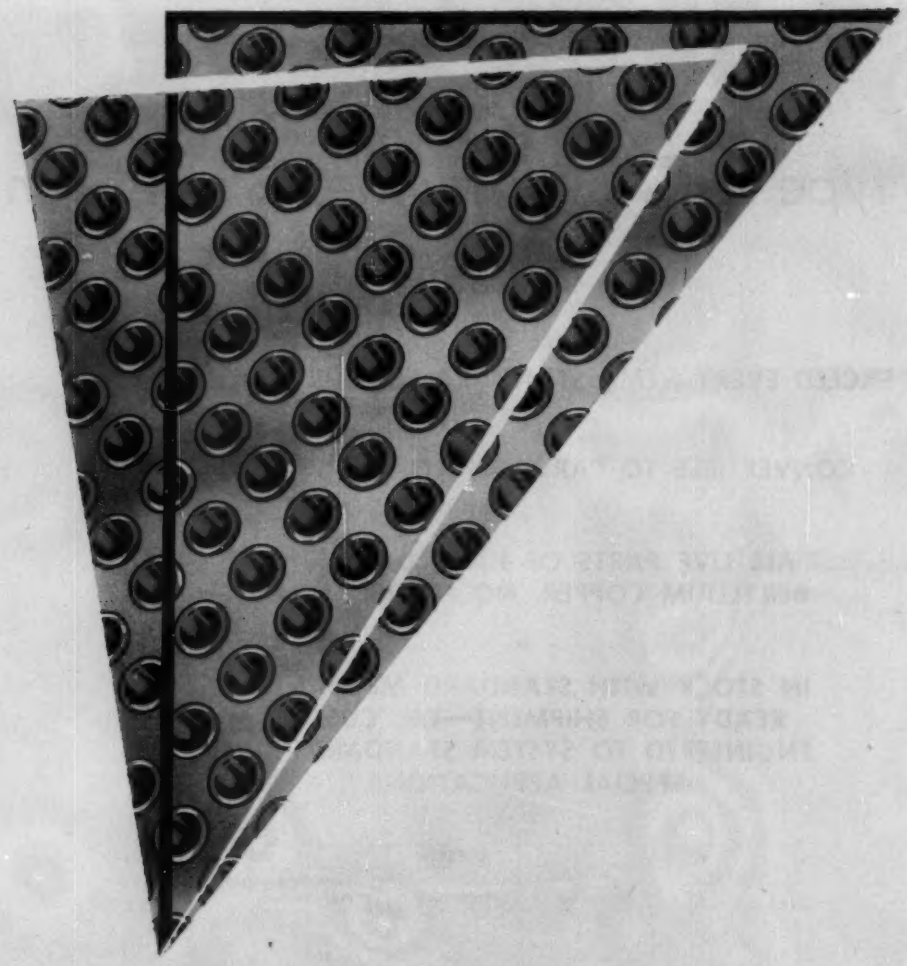
TERMINALS—Tinned copper, or all-aluminum with copper lined terminal pad.

R&IE

R&IE EQUIPMENT DIVISION

I-T-E CIRCUIT BREAKER COMPANY

GREENSBURG, PA.



It's a fact! ...CHASE® CONDENSER TUBES

resist corrosion better!

The proof! To date, more than one hundred and twenty million pounds of Chase Antimonial Admiralty Condenser Tubes have been installed in heat exchangers and condensers. They have set an amazing record of performance! You are assured far more years of dependable, trouble-free service – under *all* conditions with Chase Antimonial Admiralty Condenser Tubes. Get the facts first-hand! Write for your free 54-page manual: "*Chase Condenser and Heat Exchanger Tubes.*" Do it today!

Chase

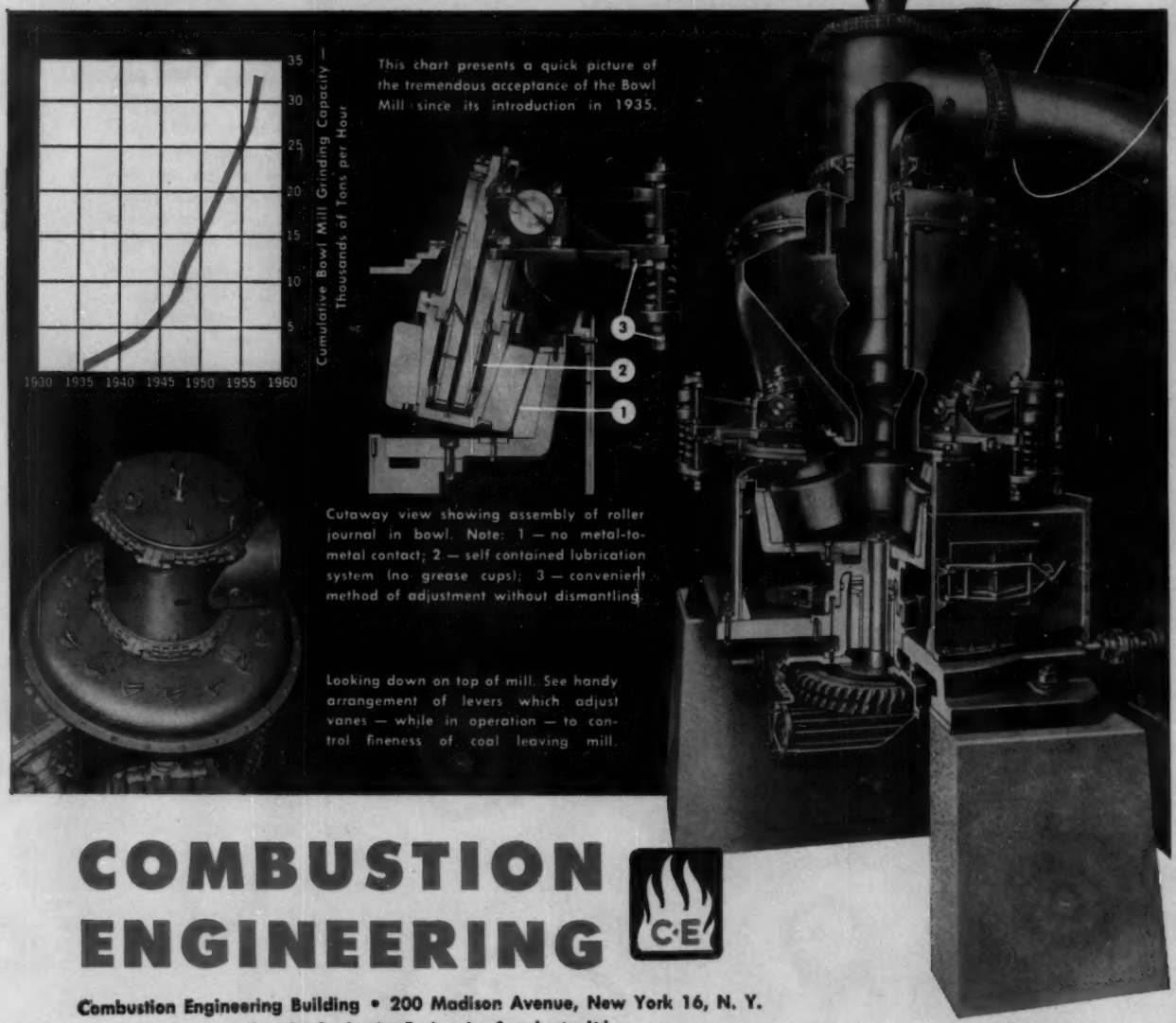
BRASS & COPPER CO.
WATERBURY 20, CONNECTICUT
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper and Stainless Steel
Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L.I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

The Fifty Largest Utilities as listed in the 1957 FORTUNE DIRECTORY
★ American Tel. & Tel. (New York)
★ Pacific Gas & Electric (San Francisco)
★ Consolidated Edison of New York
★ Commonwealth Edison (Chicago)
★ American Gas & Electric (New York)
★ Tennessee Gas Transmission (Houston)
★ Public Service Elec. & Gas (Newark, N. J.)
★ Southern California Edison (Los Angeles)
★ Southern Co. (New York)
★ Detroit Edison (Detroit)
★ Philadelphia Electric (Philadelphia)
★ Niagara Mohawk Power (Syracuse, N. Y.)
★ General Telephone (New York)
★ El Paso Natural Gas (El Paso, Texas)
★ Columbia Gas System (New York)
★ General Public Utilities (New York)
★ Consumers Power (Jackson, Mich.)
★ American & Foreign Power (New York)
★ American Natural Gas (New York)
★ United Gas (Shreveport, La.)
★ Texas Utilities (Dallas)
★ Middle South Utilities (New York)
★ Pacific Lighting (San Francisco)
★ Texas Eastern Transm. (Shreveport, La.)
★ Consolidated Natural Gas (New York)
★ Central & South West (Wilmington, Del.)
★ New England Electric System (Boston)
★ Pennsylvania Power & Light (Allentown)
★ Union Electric (St. Louis)
★ Ohio Edison (Akron)
★ Virginia Electric & Power (Richmond)
★ Peoples Gas Light & Coke (Chicago)
★ Northern States Power (Minneapolis)
★ Cleveland Electric Illum. (Cleveland)
★ West Penn Electric (New York)
★ Duke Power (Charlotte, N. C.)
★ Long Island Lighting (Mineola, N. Y.)
★ Baltimore Gas & Electric (Baltimore)
★ Duquesne Light (Pittsburgh)
★ Northern Natural Gas (Omaha, Neb.)
★ Wisconsin Electric Power (Milwaukee)
★ Transcontinental Gas Pipe Line (Houston)
★ Panhandle Eastern Pipe Line (New York)
★ Public Service of Indiana (Plainfield)
★ Florida Power & Light (Miami)
★ Illinois Power (Decatur, Ill.)
★ Western Union Telegraph (New York)
★ Boston Edison (Boston)
★ New York State Electric & Gas (Binghamton)
★ Cincinnati Gas & Electric (Cincinnati)
© 1957 Time Inc.
Among the 50 largest utilities, only one electric or telephone utility is a Preformed prospect...
the rest are Preformed customers
In July, 1947, Preformed Line Products Company didn't have a customer; all the electric and telephone utilities were prospects. Today, the situation is almost completely reversed.
For example, in FORTUNE's list of the "Fifty Largest" utilities, only one of the electric and telephone utilities mentioned is still a prospect; all the rest are now Preformed customers. In other words, the Preformed principle of using preformed helical rods for line accessories has gained almost complete acceptance in only 10 years.
If you are among the few utilities not utilizing Preformed, you might ask "Why?". PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland ...in 10 years the leading manufacturer or armor rods, dead-ends, Guy-Grip dead-ends, splices and other line accessories.
PLP
You can look up to Preformed

Why the Bowl Mill is

AMERICA'S No. 1 PULVERIZER


Cumulative Bowl Mill Grinding Capacity
Thousands of Tons per Hour
35
30
25
20
15
10
5
1930 1935 1940 1945 1950 1955 1960
This chart presents a quick picture of the tremendous acceptance of the Bowl Mill since its introduction in 1935.
3
2
1
Cutaway view showing assembly of roller journal in bowl. Note: 1 — no metal-to-metal contact; 2 — self contained lubrication system (no grease cups); 3 — convenient method of adjustment without dismantling.
Looking down on top of mill. See handy arrangement of levers which adjust vanes — while in operation — to control fineness of coal leaving mill.

COMBUSTION ENGINEERING

C-E

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.
Canada: Combustion Engineering-Superheater Ltd.

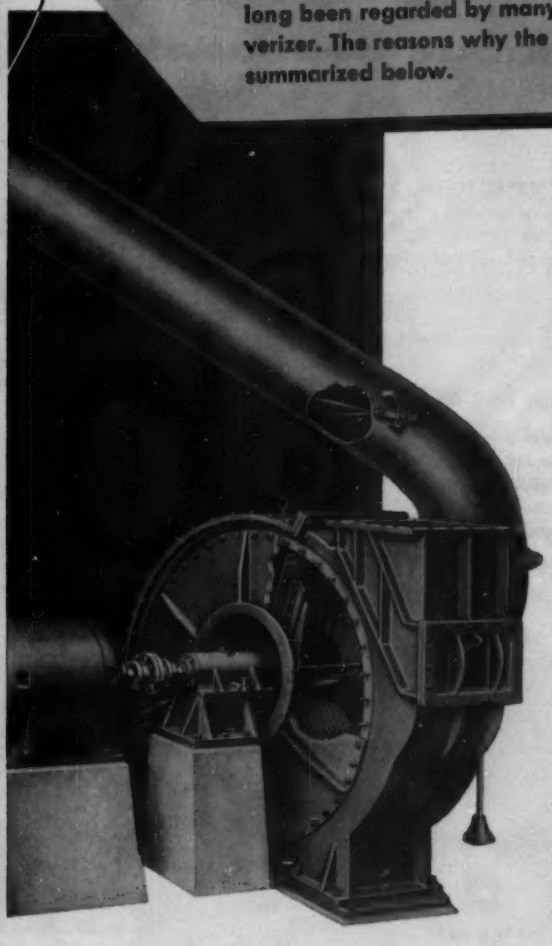
B-757

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

A first-class pulverizer should possess certain basic capabilities of which the following — most operators will agree — are the most important. They are the ability to . . .

- *handle high moisture fuels without difficulty*
- *operate with low power requirement*
- *stay in continuous service for long periods*
- *operate with low maintenance costs*
- *permit convenient control of fineness while running*
- *adjust grinding pressure automatically*
- *lubricate, when required, while in operation*
- *operate quietly and without vibration*

It is because the C-E Raymond Bowl Mill measures up on <u>all</u> these points that it has long been regarded by many leading power engineers as the country's No. 1 pulverizer. The reasons why the Bowl Mill is an outstanding all-around performer are summarized below.



HIGH MOISTURE — The most effective means of achieving good pulverizing results with high moisture fuels (16 — 18% — Eastern coal, 24% Midwestern, 45 — 50% lignites) are (1) by the admixture of fuel already dried in the mill with the raw feed and (2) by the use of high temperature air. The C-E Raymond Bowl Mill was designed to do both of those things, and does them well. Air temperatures of 700° F. and above can be utilized.

LOW POWER CONSUMPTION — Basic design characteristics of the Bowl Mill permit pulverizing at less power per ton of material than any mill now available. The rapid flow of material through the mill and the prompt removal of fine coal as it is produced prevents over-grinding. This, in conjunction with the relatively low mass of grinding elements and rapid drying action in the mill, assures minimum power consumption.

RELIABILITY — Design and materials are responsible . . . but results prove the point — such results for example as operating records of 8500, 10,000, 15,000, 20,000 continuous service hours without repair or replacement of parts.

MAINTENANCE — Bowl Mill maintenance cost has always been the lowest in the field. Continuing improvements in designs, materials and construction keep it that way. A minimum of outage time is required for dismantling and assembly. It's a matter of record in many plants that higher costs of material and labor over the past 15 years have not been reflected in increased maintenance cost per ton of coal pulverized.

FINENESS CONTROL — All necessary adjustments to control fineness of finished product can be made conveniently from the outside of the pulverizer *while it is in operation.*

AUTOMATIC GRINDING PRESSURE — The arrangement of spring-loaded roller journals on the Bowl Mill provides automatic compensation for the variation in pressure between grinding surfaces required by variation in grindability of coals.

LUBRICATION — Is no problem with the Bowl Mill. When required — at infrequent intervals — all lubrication is handled from outside the mill while it is in service.

VIBRATIONLESS — QUIET — The Bowl Mill's grinding rollers make no metal-to-metal contact with the grinding ring, assuring quiet, vibrationless operation.

• • •

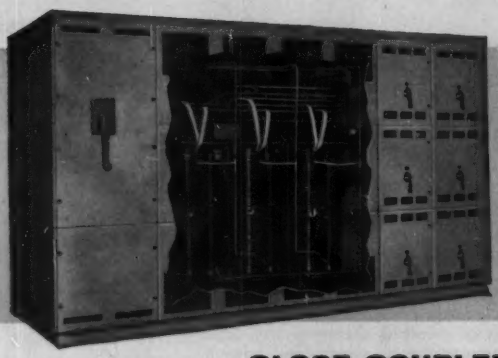
Whether you are evaluating pulverizers for your present plant expansion program or for future requirements, we suggest you use the above check list to get the facts. Send for Catalog PC-8 for further details.

PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

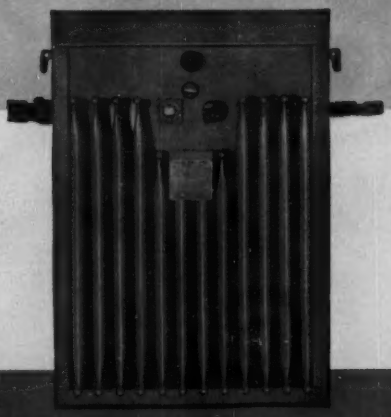
Can your in-plant distribution

WAGNER UNIT SUBSTATION

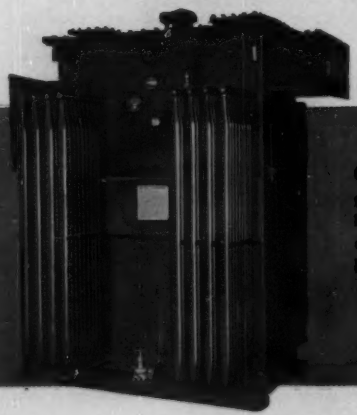
continuous dependable



DRY TYPE (OPEN, VENTILATED)—For indoor use only. Normally installed in a dry, dust-free atmosphere in a well-ventilated location. Light in weight... ideal for multi-storied buildings... no fireproof vaults necessary.



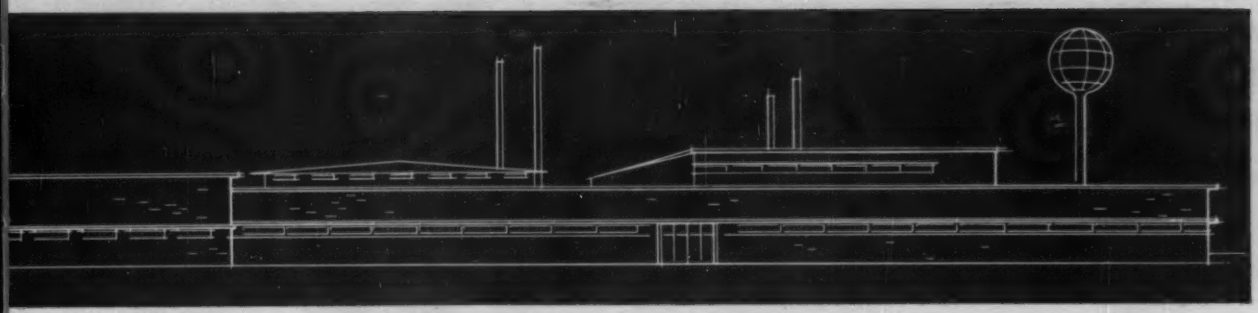
CLOSE-COUPLED. These liquid-filled transformers fit flush against switchgear enclosures, eliminating throats and saving space... available in ratings from 500 through 2000 kva. Connections are made at the bushings on the sides of the transformer.



OIL AND NOFLAMOL-FILLED. Oil-filled transformers are generally used outdoors. They can be used indoors if fireproof vaults are provided. Noflamol type in this model is filled with a non-inflammable liquid making it especially suitable for chemical plants, refineries and other locations where explosive liquids and gases are present.

NITROGEN-FILLED. These Class H Silicone Insulated Transformers offer many advantages in maintenance and safety. Suitable for indoor or outdoor use ... covers are welded to tank... no cleaning problems, even in dust-filled areas... completely fireproof. In ratings up to 2000 kva.

LIVE BETTER ELECTRICALLY



system meet tomorrow's needs?

TRANSFORMERS will assure power for years to come

Nothing is more important to your plant than an uninterrupted flow of power. You can't afford to be handicapped by a system that is unable to meet expanding demands. Your in-plant distribution system must be planned with an eye to the future—with plenty of capacity and flexibility for growth.

It will pay you to check over your distribution system—find out how adequately your transformers meet present and *future* load requirements.

And it will pay you to specify Wagner PREDESIGNED Transformers for your load-centers. You will save time—save job engineering costs—and get liberally designed transformers with the switchgear of your choice. Wagner PREDESIGNED Transformers are engineered to meet heavy industrial demands. They are built in standard ratings which are coordinated with the specifications of unit substation builders.

Bulletins TU-205 and TU-214 give full information on Wagner Unit Substation Transformers for industrial power needs. Write for your file copies today.

WAGNER DRY-TYPE TRANSFORMERS
put the right voltage close to the load

Save money through shorter runs of copper, reduced line losses, and lower installation expenses. These Wagner Dry-Type Transformers are compact, light in weight and safe to use. No fireproof vaults or other enclosures necessary... install inside or out. The 150° rise transformer is standard in ratings 3 through 10 kva and is also available through 50 kva. 55° rise model is standard in 1, 1½ and 2 kva, and the 80° rise transformer is standard in ratings 15 through 100 kva. Write for Bulletin TU-57 for full details.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

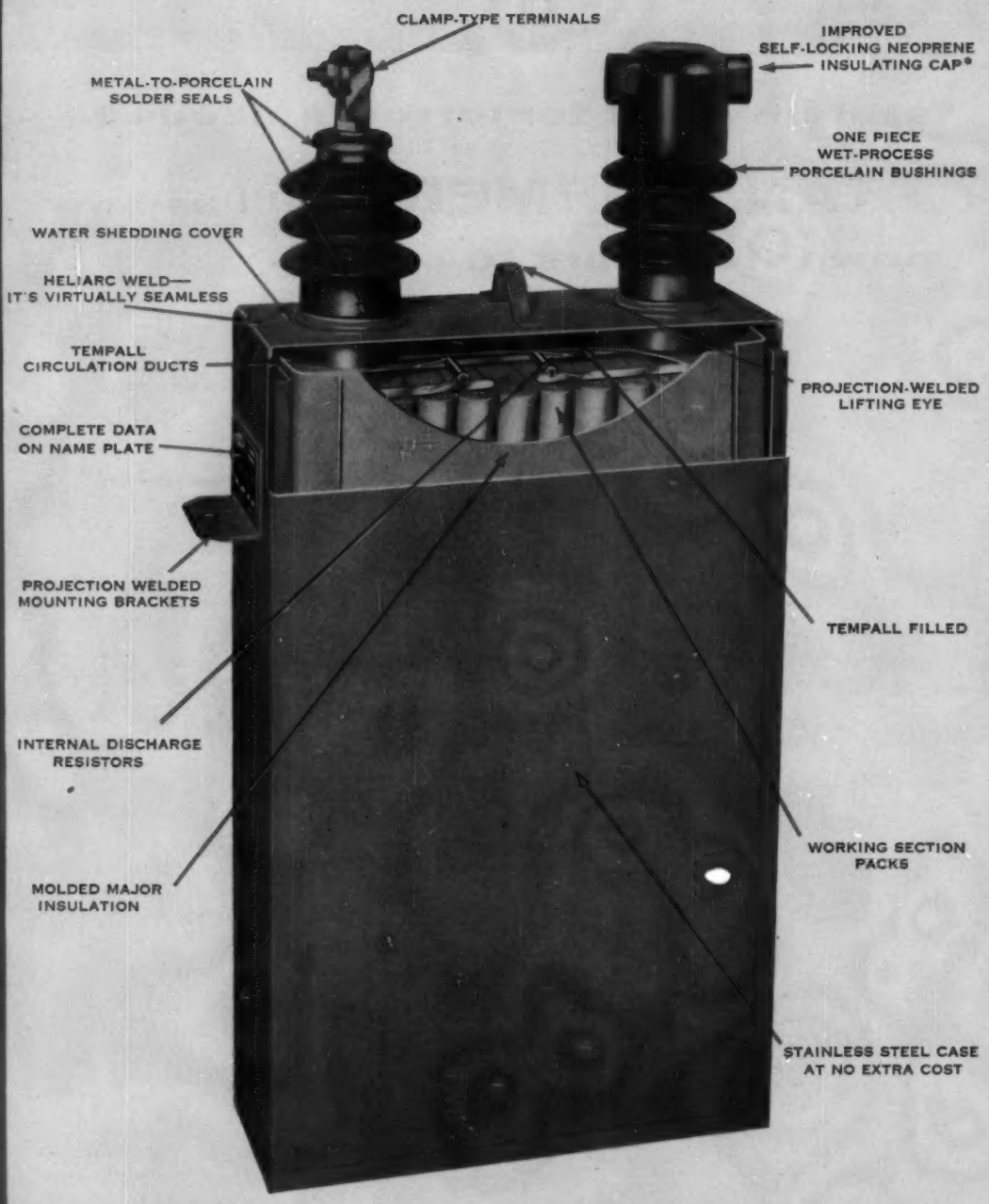
BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

757-2

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR & HYDRAULIC

TOBE invites you to lo



ok inside the capacitors . . .

BEFORE YOU BUY A HOUSE, you look a lot farther than the color of the bathroom tile. You find out how the house is really constructed!

It's smart to be just as thorough when you buy capacitors.

Here are other TOBE *features which assure efficiency and long life in* TEMPALL CAPACITORS

- *Constant quality control of individual units during manufacture, processing and tests.*
- *Each unit visually inspected during manufacturing cycle to insure complete impregnation.*
- *Special* TOBE *assembly control mechanism results in greater product uniformity.*

Because of low losses resulting from TOBE's advanced engineering design and manufacturing technique you get more correction for your capacitor dollar.

It will pay you to investigate TOBE capacitors today. Available in all standard ratings. In single units, racks, pole assemblies and complete cabinets ready for field installation and energization. Write Tobe Deutschmann Corporation, Norwood, Massachusetts or phone Norwood 7-2620, collect for further information today.

LOOK TO TOBE FOR PROGRESS

Since 1929 persistent research, trustworthy engineering, rigid production standards.

TOBE

TEMPALL CAPACITORS

*PATENT PENDING

Helping the industry meet its growing loads

Westinghouse Pioneers cost-saving unit for Bergen Generating Station

ELECTRIC UTILITY EXECUTIVES are taking a thoughtful look at the lower capital cost and long-range savings brought about by a new 290-mw Westinghouse cross-compound turbine-generator. Pioneered in conjunction with the Public Service Electric and Gas Company, *two* of these Westinghouse units will soon be installed in the Bergen (N. J.) Generating Station.

The double 3600-rpm cross-compound arrangement, developed for this installation, allows a degree of standardization of components talked of but never before realized in the race to larger and larger machines.

Lower capital and operating costs will be realized by the unusual arrangement of the components. For example, *duplicate* generators and *duplicate* switchgear are used because the load is split evenly between the 3600-rpm shafts. About $500,000 is saved in this plant's first cost, through the unique method of powering the boiler feed pumps by the generator shafts.

Station costs will be lower because the time-proven components in this new machine are lighter and smaller than in other cross-compound turbine-generators.

This new Westinghouse concept for a large turbine-generator clearly demonstrates that Westinghouse continues searching for . . . and succeeds in discovering . . . new and more economical designs to help the industry meet its growing loads. J-97214

Model of one of the two Westinghouse 290-mw turbine-generators designed for the Bergen Generating Station. Unusual feature: boiler feed pumps are driven by the shafts of the duplicate generators. L to R: W. C. Wood, Westinghouse Newark District Manager with J. R. Carlson, Manager of Engineering, Westinghouse Steam Division, South Philadelphia Works.

Five other utilities order this new turbine-generator

Since the original order from Public Service Electric and Gas Company, the following utilities have ordered turbine-generators similar in design to the new Bergen machine: Alabama Power Company, Consumers Power Company, Pacific Gas & Electric Company, Pennsylvania Power & Light Company and Southern California Edison Company.

Highlights of new Bergen design

- Two equally rated 3600-rpm generators
- Boiler feed pumps powered by the main generator shafts
- Small tried and proven components

These are the features of the new 290-mw cross-compound, quadruple flow, reheat turbine-generator which will use an inlet steam pressure of 2350 psig, and initial temperature of 1100 F with one reheat to 1050 F.

Fewer spare parts

The equal load split between the two 3600-rpm shafts results in *duplicate* generators and *duplicate* switchgear. The LP turbine elements are also *duplicates*. Because so many parts are common, fewer need to be stocked for spares.

About $500,000 saved in this plant's first cost

. . . for the two machines soon to be installed in the Bergen Generating Station. Through an unusual arrangement, the boiler feed pumps are driven by the generator shafts, eliminating the need for motors and control for these pumps. This arrangement, of course, also cuts requirements for auxiliary electric power.

Time-proven components

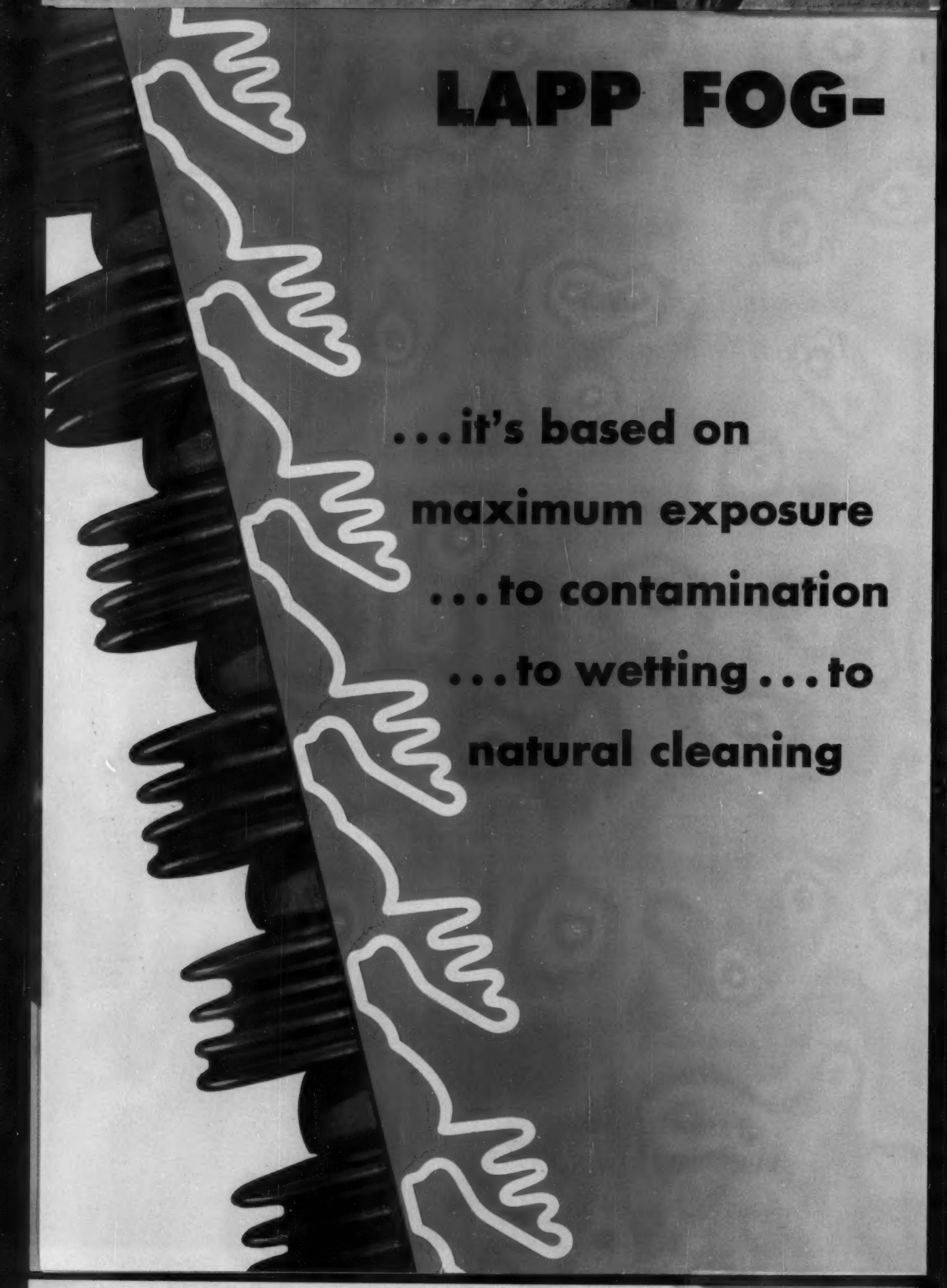
The use of conventional Westinghouse components in these large turbine-generators assures continued high level efficiency.

Lighter foundations, less space . . .

. . . less crane capacity and headroom and lower shipping and handling costs. The two high-speed shafts permit the use of smaller and lighter components than are used in conventional 3600/1800-rpm cross-compound machine.

YOU CAN BE SURE...IF IT'S

Westinghouse


LAPP FOG-
...it's based on
maximum exposure
...to contamination
...to wetting...to
natural cleaning

TYPE DESIGN

Nobody wants power arcovers. They cause service interruptions, set fire to equipment, add to maintenance costs, and pull line crews out of bed on foul nights.

But power lines do have to run through areas where dust, salt-spray, chemicals—even automotive exhaust fumes—combine with fog or rain to coat insulators with a conductive material such that leakage flashover can occur unless special steps are taken to avoid it.

The "special steps" begin, usually, with increasing the length of leakage path. The distinguishing characteristic of every "fog type" design is the extra inches of leakage distance it provides.

Dozens (maybe hundreds) of insulator designs have been produced for operation under contaminated atmospheric conditions. All have had extra leakage distance, but few have merited a second order by a user. So it must be that the geometry of the increased leakage surface has something to do with its effectiveness.

There is one design that has been successful. It has a record of more than thirty years on this job and has generally been adopted for all types of porcelain insulators for outdoor service.

This is a brief story of the technical considerations back of this design and of the reasons why it can save you money by reducing insulator cleaning, avoiding outages, and providing more dependable operation than is possible with any other type of insulator.

The effect of any contaminant, spread over all or part of an insulator surface, is to lower the surface resistance, thus allowing more leakage current to flow.

It is here that most errors occur in the thinking about contamination problems. Most people, at first thought, consider leakage current bad—that it should be prevented from flowing. As a matter of fact, however, it is the leakage current that saves the insulator, because it is continually drying and correcting the low resistance which fog or drizzle has caused.

Variations in thickness, width of path, and wetness in various areas of the surface result in non-uniform leakage surfaces. These variations are caused by the cleaning action of wind and rain, by non-uniformity in width of surface, by shielding parts of the surface from rain. When rain falls on a dirty insulator, resistance of the wet part is lowered. Since the total resistance is reduced, more current flows, but this current dries the shielded high-resistance areas even more rapidly. Thus voltage piles up over these high-resistance sections, showing increasing fire and arcing, precipitating flashover.

It's the dry, high-resistance areas of insulator surface that start flashover, and any attempt to shield insulators, or parts of them, is to invite flashovers by creating "hot spots" which initiate the flashovers.

The Lapp principle of Fog-Type design seeks uniformity and tries to obtain this uniformity by maximum exposure—to contamination, to wetting, to natural cleaning by wind and rain. It is typified by short petticoats, spaced to avoid pockets where contamination and moisture can accumulate. In the suspension unit, the smooth underside is also designed for maximum exposure with no restricting baffles to prevent cleaning. Spacing of petticoats is designed to obtain natural cleaning from water flow and splashing from below.

In most areas, no cleaning of Lapp Fog-Type insulators is required. Where a program of maintenance cleaning is necessary, time intervals for cleaning Lapp units may be extended beyond that required for other types of insulators, and the fully exposed leakage path makes such cleaning easy, fast, and economical.

The merit of this principle, and of the design, is confirmed by the service record of Lapp Fog-Type units. Those we ship today look just about like those we produced thirty years ago, and users of these thirty-year-old units have had little reason to look for new concepts of fog design. In the years since, the principle has been adapted to many types of outdoor insulators. Identical fog-type corrugations, used extensively today for high voltage bushings, have obsoleted the wide, spreading petticoats which were previously standard. Major advantages in performance, both mechanical and electrical, of Line Post and Station Post insulators are derived from the adoption of these designs of Lapp Fog-Type corrugations.

You improve the service record of your system, save your company maintenance expense, and improve the sleeping habits of your line crews every time you build a line on Lapp Fog-Type insulators.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Shown here, inspecting Kansas City Power & Light's new Mobile units are, left to right: I. C. McLain, RT&E representative; R. L. Wright, E. D. Church and F. D. Cochran of Kansas City Power & Light.

KANSAS CITY POWER & LIGHT MAINTAINS SERVICE WITH RT&E EQUIPPED MOBILE UNITS

When necessary repairs must be made to Kansas City Power & Light's line installations, there's no shut-down on power to customers. Mobile substations like these are wheeled into action, taking over the transformer job while replacement or repairs are made on line units. Service is maintained without interruption.

The heart of these mobile substations depends on versatile RT&E **DUAL VOLTAGE TRANSFORMERS** . . . rated at 100KVA, 2400x7620 — 120/240/277 volts with *Externally Operated Taps* at 8000/7810/7430/7200 volts. These special units also incorporate RT&E's *Externally Operated primary voltage change-over switch.*

This is just another example of RT&E transformers at work, proving again their merits with many of the industry's outstanding and exclusive features.

EXCLUSIVE WOUND CORE
"WEATHER PROTECTED" DESIGN
EXTERNALLY OPERATED CHANGE-OVER SWITCH
EXTERNALLY OPERATED TAPS
FIVE YEAR GUARANTEE

Ask your RT&E representative to demonstrate the five sound reasons why RT&E transformers are better. Or write RT&E Corporation, Waukesha, Wisconsin.

RT&E CORPORATION WAUKESHA, WISCONSIN

HELPING PROVIDE POWER FOR AMERICA

This tower is one of many at Alcoa's large outdoor test facilities at Massena, New York, for research into the causes and cures of wind-induced conductor vibration.

WHAT ALCOA IS DOING ABOUT CONDUCTOR VIBRATION

ALCOA RESEARCH

...Development today for tomorrow's loads

ALCOA RESEARCH DISCOVERS...HOW TO TAKE THE SHAKES OUT OF CONDUCTORS

At Massena, New York—a location favored for the prevalence and range of velocity of its winds—Alcoa has maintained since 1927 the world's largest facilities for research into the causes and cures of conductor vibration. Here, a team of highly specialized scientists, engineers and technicians is constantly at work on the development and testing of devices for the prevention of vibration damage to conductors.

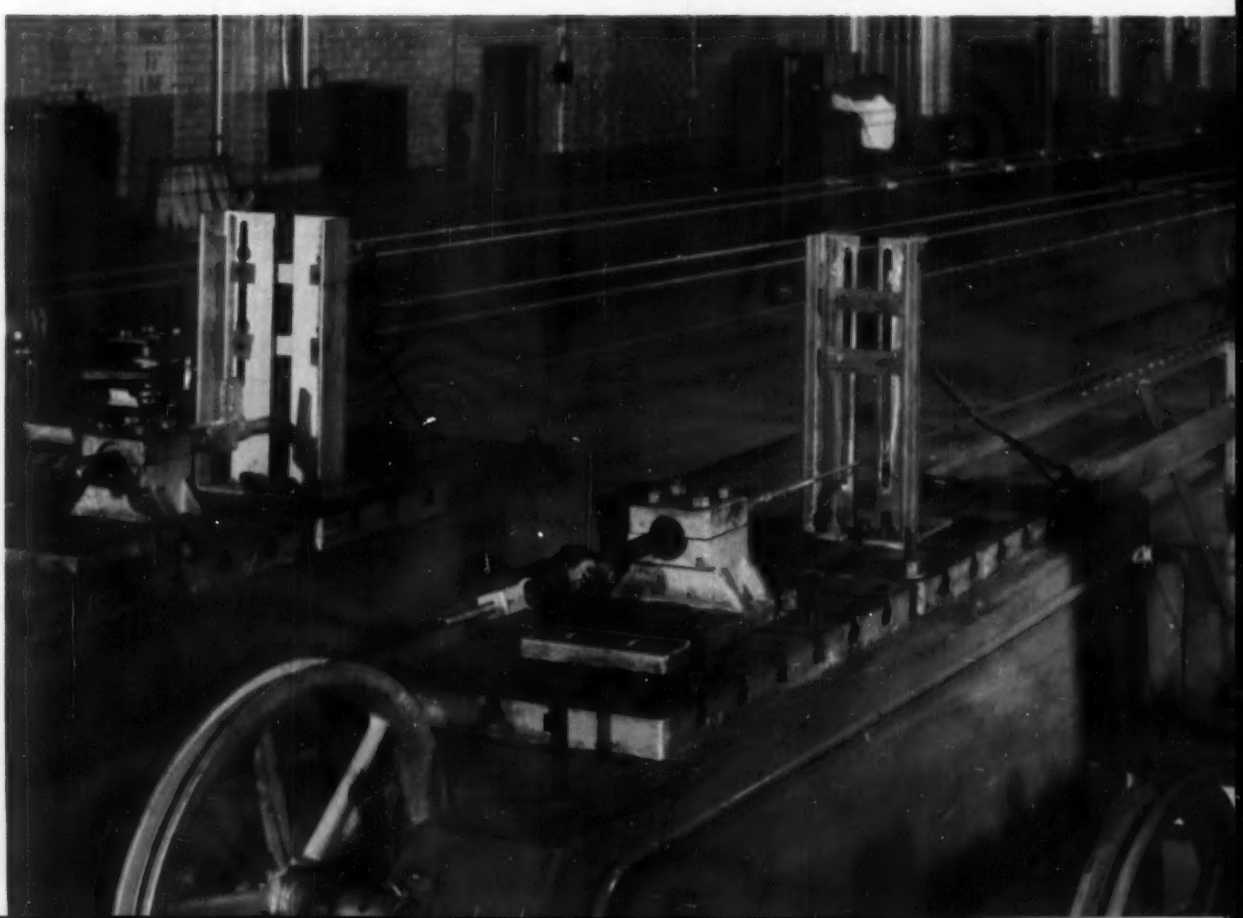
In the inside laboratory, equipment is available for simultaneous testing of several conductors under controlled high tension. Continuous vibration is artificially induced, and with the controlled conditions, test results can be obtained much faster. In addition, there are many outdoor test spans ranging in length from 200 to 1,500 feet.

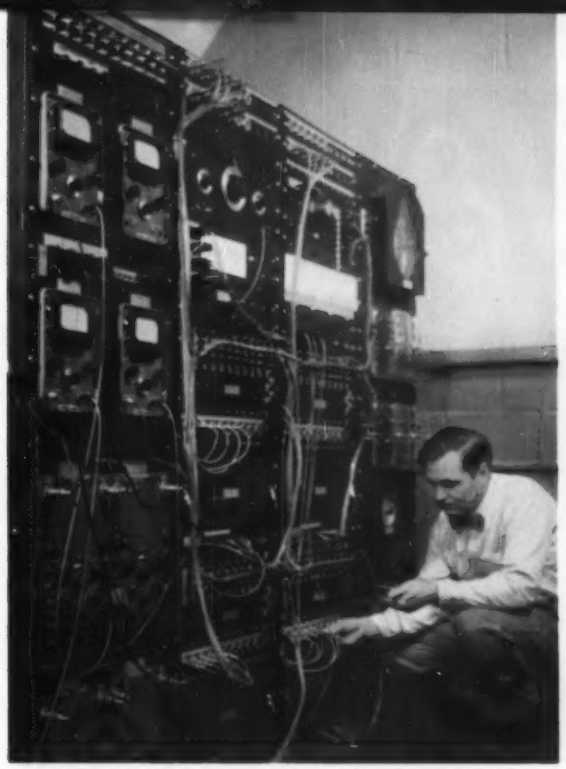
Overhead conductors of any material will, under the right conditions, be subject to wind-induced vibration. As conductor tension is increased, the tendency to vibrate increases. The frequency of vibration is related to the wind velocity and conductor diameter. The loops that form in a vibrating conductor are analogous to the behavior of a violin string under a bow.

Unfortunately, however, any sound that results is not "music to the ears," since it can signal the possibility of fatigue damage to the conductor. More than 35 years ago, broken strands were first associated with aeolian vibration of overhead conductors. As soon as the problem became apparent, Alcoa at once put some of its best minds to work on it. As a result of Alcoa's research work and the knowledge gained from observations of operating lines in many parts of the world, the major problems of vibration have been solved.

There are still questions to be answered, however. Intense research and development on the problem continue. As a result of this program, you can look to Alcoa for the latest developments in devices for preventing vibration or in limiting its effects.

Armor rods, developed and perfected by Alcoa engineers, and patented Alcoa® Stockbridge dampers, which have been modified and refined in the laboratory, are the two weapons that deal a knockout blow to the vibration problem. Work done on this problem is typical of how the Electrical Engineering Division of Alcoa Research Laboratories serves you.





This electronic equipment automatically records the natural vibration of transmission lines on Alcoa's outdoor test spans in Massena. Researchers have made intensive studies of the power input of the wind, the power dissipated in the conductor and the power absorbed by damping devices.

Photoelectric equipment is used to measure the amplitude of vibration of a conductor. Because Alcoa's study of vibration in conductors was begun more than 35 years ago, a great storehouse of information has been accumulated on the subject. Considerable equipment has been developed to permit detailed studies of the phenomenon.

Equipment for determining dynamic characteristics of vibration dampers. The device on test is a Stockbridge damper, named for its inventor, George H. Stockbridge. Alcoa purchased the patent of this damper in 1930 and has added many improvements since the original development.

Part of the mechanical test section of the Electrical Engineering Laboratory maintained by Alcoa Research Laboratories at Massena, New York. With this equipment, the necessary tension can be applied to the conductors on vibration test. In some cases, specimens must withstand 500,000,000 cycles of "torture" before the cable they represent is passed for service.

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

ALCOA RESEARCH...

...Development today for tomorrow's loads

Alcoa's crack research team of scientists and engineers meets in regular session at Massena, New York, to evaluate results and chart the future course of the latest research on conductor vibration.

With the use of electrical energy doubling nearly every 10 years, there is a constant need for new and better products. From the early infancy of the electrical industry, Alcoa has worked closely with utilities on the problems of cable fatigue and aeolian vibration. As the electrical industry grew, so did its problems. To help solve them, Alcoa developed armor rods and the Stockbridge damper. Then, as other problems came up, a special division was set up in 1948 known as the Electrical Engineering Division of Alcoa Research Laboratories.

At these laboratories in Massena, New York, work is carried out on all problems involving the use of aluminum in electrical conductors. Continuous tests are made on conductors and connectors under conditions as similar as possible to those encountered in the field. Many of these tests are concerned with measuring the electrical characteristics of various types of ACSR. Other tests range from determining the time and electric current necessary to melt ice from overhead cables under different conditions to such relatively new problems as reduction of radio interference caused by extra-high voltage transmission lines. The aim of all the testing and research remains the same—to make available to the electrical industry the most modern and efficient cable and accessories at the lowest possible cost.

Your Guide to the Best in Aluminum Value

ALCOA
ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

NEW! "ALCOA THEATRE"
Exciting Adventure
Alternate Monday Evenings

MOLDED CASE CIRCUIT BREAKERS

The I-T-E Cordon plug-in circuit breakers pictured in the control board above distribute current to machines in the Yorklyn, Del., plant of National Vulcanized Fibre Co., world's largest manufacturer of vulcanized fibre.

"We selected I-T-E breakers to solve our problem in the manner we desired," says John L. Bahr, chief engineer for National Vulcanized Fibre Co.

"I-T-E CORDON® Plug-in Breakers Proved the Most Economical and Convenient Way to Meet Our Increased Power Capacity Needs"

"The growth of our company over the years required the addition of a public utilities tie line into our Yorklyn, Del., plant to supplement the plant's generating facilities. This move created two problems: it meant that we would have to substantially increase the maximum potential current interrupting capacity of our control board; and within a limited amount of space available.

"After considering several possibilities, we found that I-T-E Cordon plug-in type circuit breakers would solve both problems. We were able to satisfy our interrupting capacity requirements in the existing control board space. And plug-in features permit taking out any circuit when necessary without shutting down the entire board."

I-T-E Cordon circuit breakers combine the usual thermal magnetic trip unit for protection against overloads with current limiting Amp-traps,* which assume the fault clearing duty when actual short circuits occur. Thus I-T-E Cordon circuit breakers extend the interrupting capacity to 100,000 rms amperes without the necessity of designing special structures for maximum available shorts. Ask your I-T-E representative for complete details or write Small Air Circuit Breaker Division, 19th & Hamilton Streets, Phila. 30, Pa.

**Amp-trap is a registered trademark of the Chase-Shawmut Co.*

SMALL AIR CIRCUIT BREAKER DIVISION

I-T-E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STREETS PHILADELPHIA 30, PENNSYLVANIA

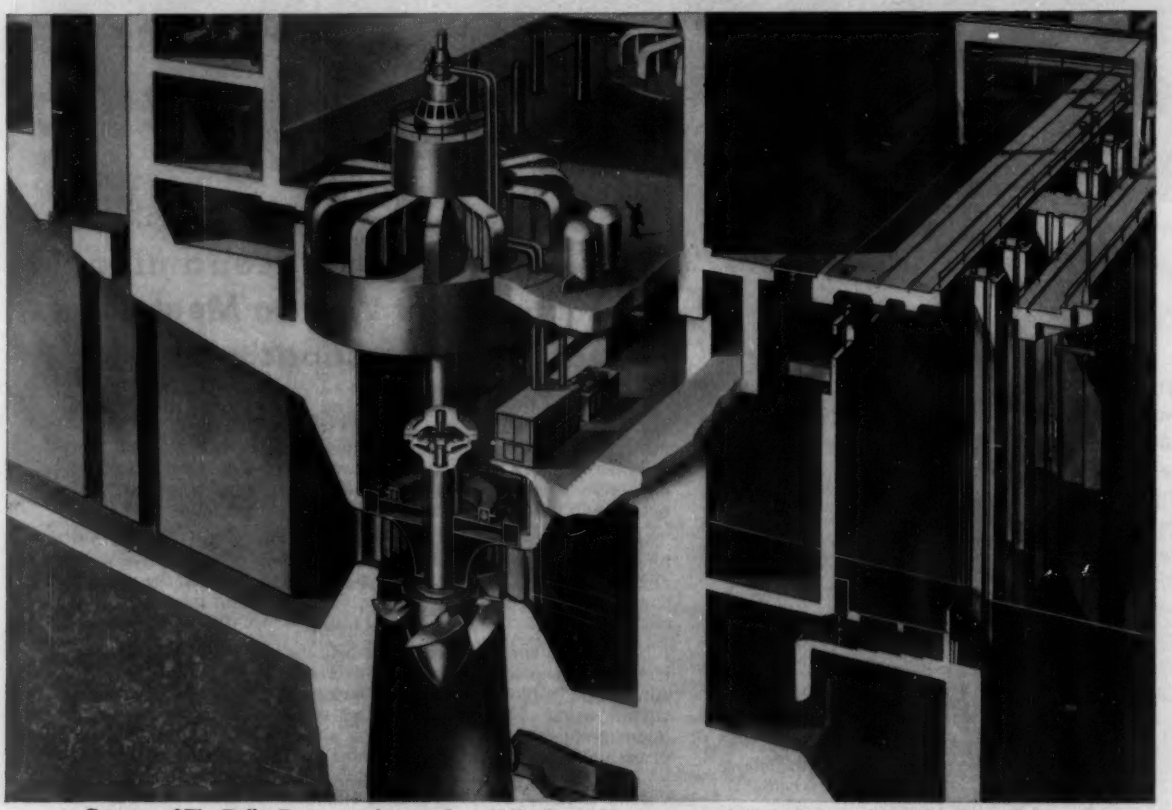
Pelton makes world's largest Kaplan turbine governors for The Dalles Dam

Of the 16 Kaplan turbine governors which Baldwin-Lima-Hamilton's Pelton Division is supplying for The Dalles Dam, located on the Columbia River, 14 are the largest ever built. Each has a wicketgate capacity of 950,000 ft.-lb. and a Kaplan blade capacity of 720,000 ft.-lb. In order to be absolutely certain that they will meet contract specifications in every respect, Pelton exhaustively tests these governors under simulated power plant conditions prior to installation.

In addition to governors, B-L-H is furnishing The Dalles Dam with 14 Kaplan type turbines, each rated to deliver 123,800 hp at 85.7 rpm under 81-ft. head. Station service units are also being produced for this project by B-L-H's Pelton Division. The Dalles Dam is thus a superb testimonial to Baldwin-Lima-Hamilton leadership in the design and manufacture of hydraulic turbines and related equipment.

For a copy of our newest illustrated bulletin, write B-L-H Corporation, Philadelphia 42, Pa., or Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.

An inspection of one of the 16 Kaplan turbine governors for The Dalles Dam is made at B-L-H's Pelton Division.



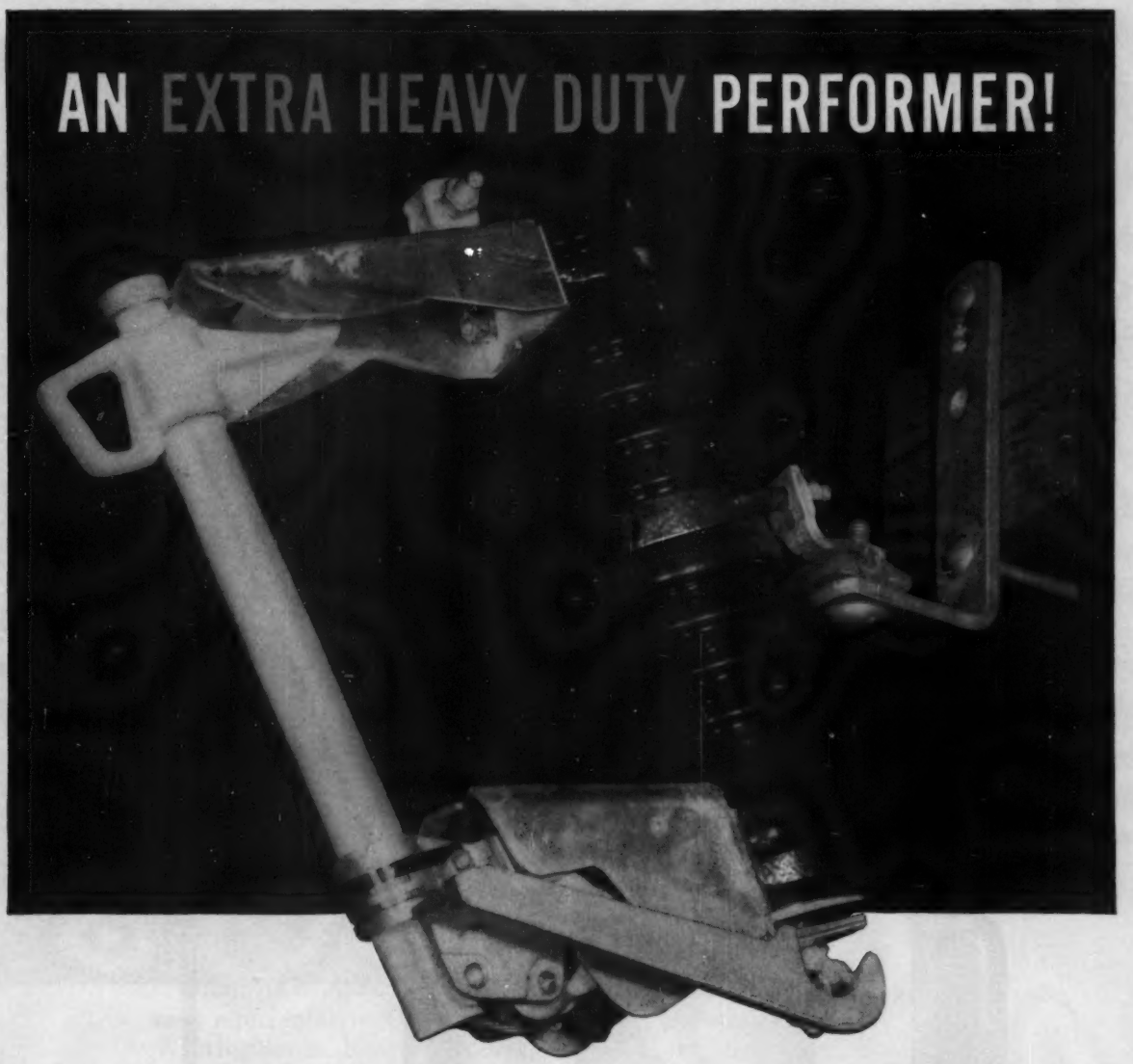
Cutaway of The Dalles Dam powerhouse, where 16 Kaplan turbine governors built by Baldwin-Lima-Hamilton's Pelton Division and 14 Kaplan turbines built by the Eddystone Division of B-L-H are being installed. Artist's rendition courtesy of Portland District, Corps of Engineers, U.S. Army.

Pelton Division San Francisco, Calif.

BALDWIN · LIMA · HAMILTON

Hydraulic turbines • Valves • Governors • Centrifugal pumps

AN EXTRA HEAVY DUTY PERFORMER!



10,000-amp interruption conclusively PROVED in the High Power Lab!

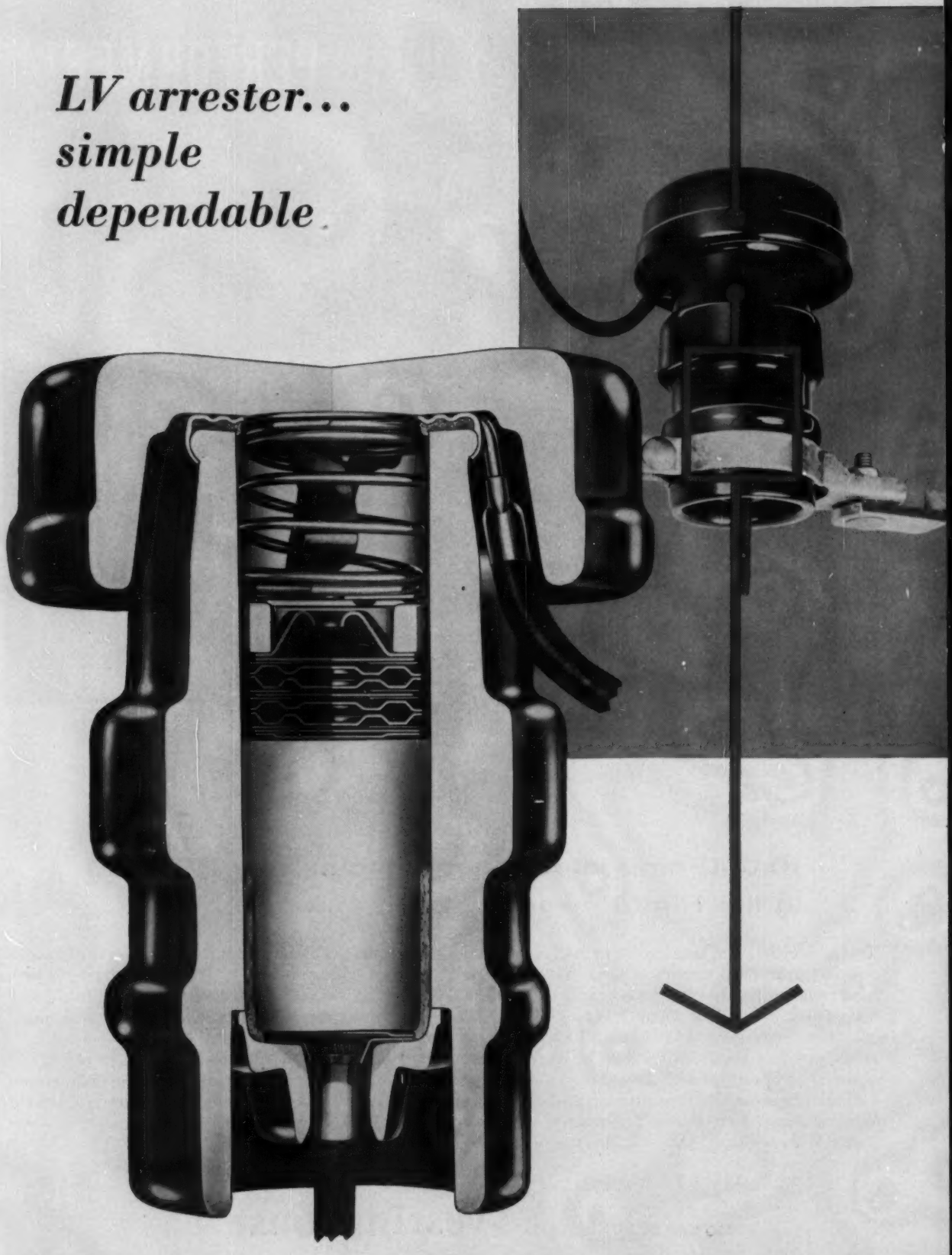
To provide the *extra* measure of protection so vital on your growing distribution lines, Westinghouse has extended the capacity of its time-proven line of open fuse cutouts. The Extra Heavy Duty "DX" cutout not only interrupts faults of 10,000 amperes safely and dependably, but will do it time and time again . . . without failure!

Under the worst field conditions, simulated at the Westinghouse High Power Laboratory, the new Extra Heavy Duty "DX" cutout was given the thorough kind of workout that assures you of reliable circuit protection on 5.2, 7.8 or 15 kv lines . . . with 100-amp continuous rating. A rugged load-break device, shown above, is available for economical switching of lines under full load.

For further information on the improved "DX" cutout, contact your Westinghouse Sales Engineer, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60936

YOU CAN BE SURE...IF IT'S Westinghouse

LV arrester... simple dependable



LIFE
IS IN THE BALANCE

Optimum balance between electrical characteristics and arrester life results in the best arrester.

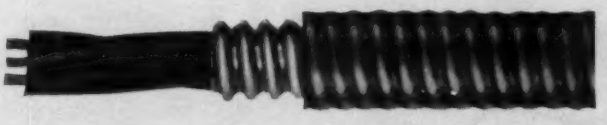
Westinghouse LV valve arresters achieve this balanced performance . . . protection without needless operation . . . long life without courting trouble . . . the highest order of moisture protection eliminating radio and TV interference.

The integrity of the LV design has been proved by 17 years of trouble-free field service—another reason why you should specify Westinghouse LV arresters.

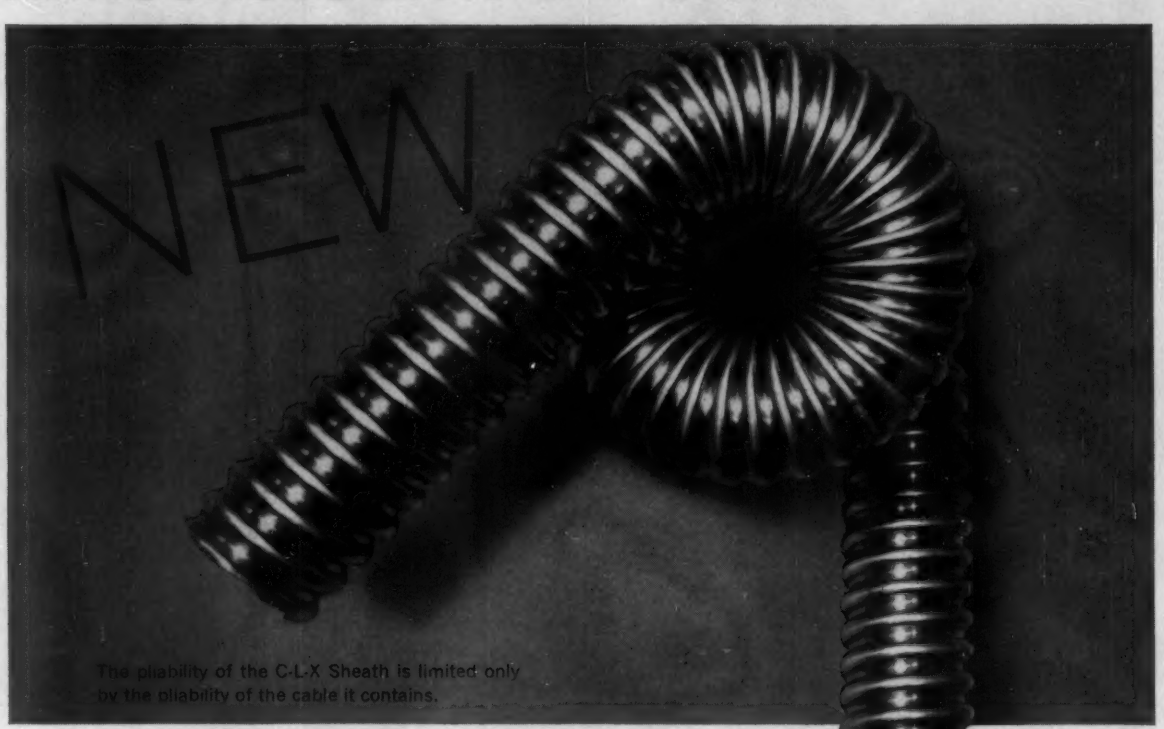
Complete information is available from your Westinghouse sales representative. Or write for Descriptive Bulletin 38-140. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60025

YOU CAN BE SURE... IF IT'S Westinghouse

Simplex



ANNOUNCES the C-L-X* Sheath



The pliability of the C-L-X Sheath is limited only by the pliability of the cable it contains.

...an entirely new closed system that gives incomparable benefits in all types of cable installations

Simplex C-L-X is a Continuous Lightweight eXterior metallic sheath that is impervious to gases, chemicals and water. Its unique construction gives it a combination of properties that is unmatched by any cable system now manufactured in the United States.

C-L-X provides a completely sealed conduit — with "built-in" cable. C-L-X combines all the advantages of lead sheathed and interlocked armored cables. In addition, it has its own intrinsic qualities of great strength with extremely light weight. It is suitable for installation in trays or by clamps. C-L-X can be used aerially or buried directly in the ground. Its pliability permits ease of installation.

For more than a decade, this type of cable protection has given exceptional service in European installations. *Now, Simplex engineering has adapted C-L-X so that its scope of industrial applications is practically unlimited for modern American installations.* It is unequalled in situations where impermeability and durability are important.

Like all Simplex products, C-L-X is engineered for lasting quality and, therefore, *dependability*. Write for specific product data.

*(Continuous Lightweight eXterior, pronounced "Sealex")

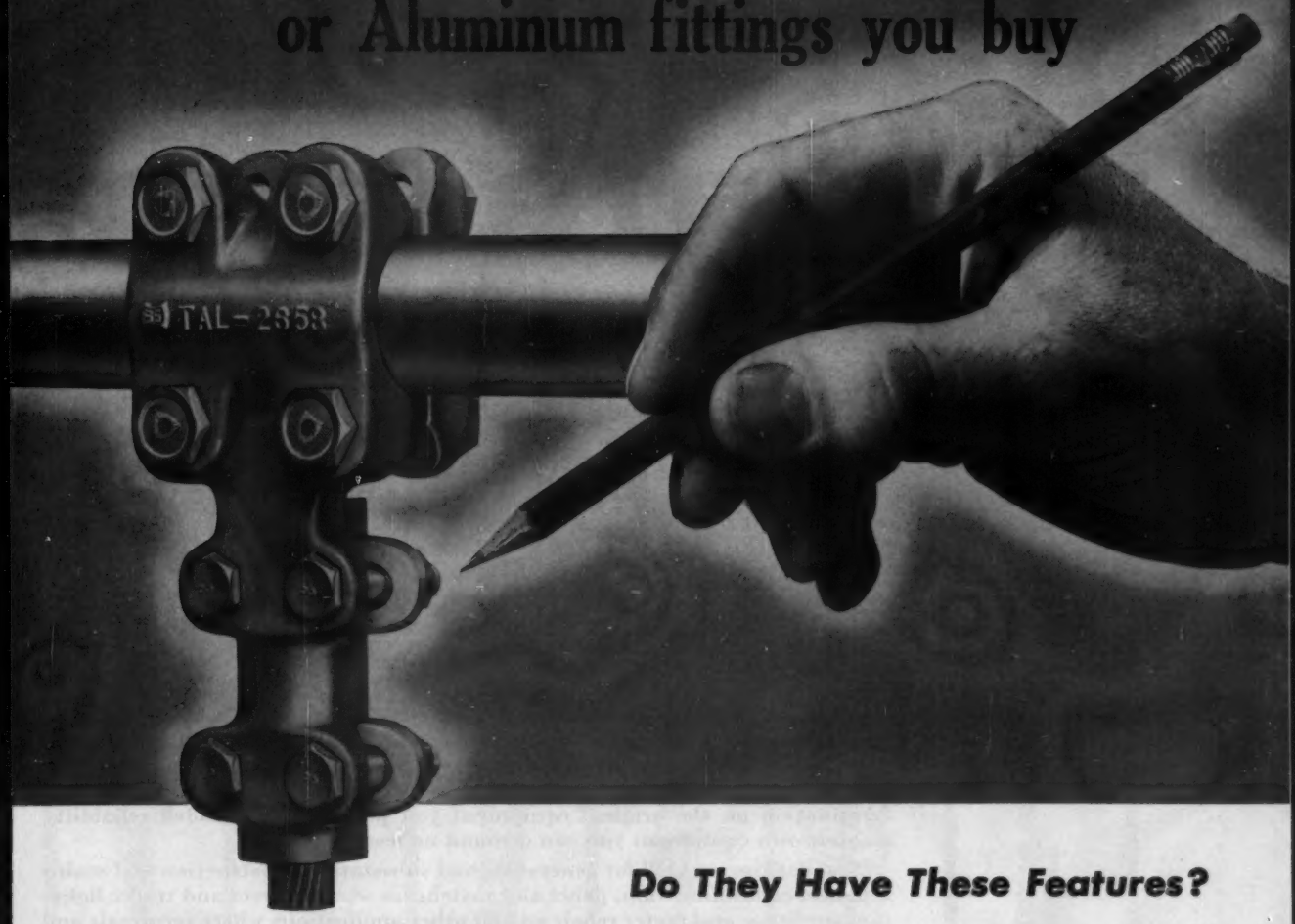
LIVE BETTER ELECTRICALLY

Simplex WIRE & CABLE COMPANY

79 SIDNEY STREET, CAMBRIDGE 39, MASS.

"the American manufacturers of transoceanic telephone cables"

CHECK POINTS for the Bronze or Aluminum fittings you buy



Southern States Connectors Meet Every Single Requirement

Never underestimate the importance of a good connection!

A faulty connection can mean trouble and cost you money!

The failure of any connector, no matter how insignificant, can cause a circuit interruption as surely as any major system component. That's why it pays to select the fittings for today's heavily loaded systems with a great deal of care.

Take a look at the check list at right. If you can't answer "yes" to these questions, then the fittings going into your system may be inadequate.

Southern States bronze and aluminum fittings meet every single requirement listed.

For complete information write for catalogs describing Southern States' complete line of bronze and aluminum fittings.

Do They Have These Features?

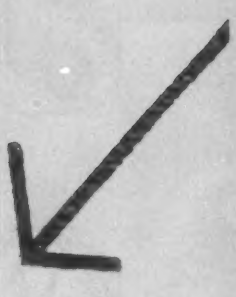
	YES	NO
Are they structurally strong enough to prevent pull-out of conductors?	☐	☐
Are stress points rugged with cross-sectional strength to spare?	☐	☐
Are bolt heads recessed for single-wrench assembly and disassembly?	☐	☐
Do contact surfaces accurately match curvature of conductor?	☐	☐
Are contact surfaces finished to provide multi-point engagement with conductor?	☐	☐
Are castings fine grained, with smooth pit-free surfaces?	☐	☐
Are contact surfaces extra-large to provide maximum engagement?	☐	☐
Are bolts of standard size and thread for ready replacement from local sources?	☐	☐
Is the over-all appearance of the connector pleasing and not excessively heavy?	☐	☐
Do they meet NEMA standards in every respect?	☐	☐

LIVE BETTER ELECTRICALLY

IN CANADA: Dominion Cutout Co., Ltd., Toronto

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

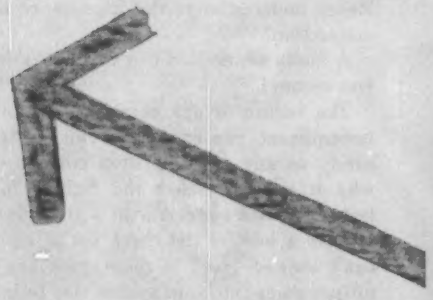
THE RIGHT DI



in design of utility systems is a composite of all that is proven and reliable in the individual components. A close inspection will reveal that generators, transformers, motors, meters, switchgear and controls—so necessary for power generation, transmission and distribution—all utilize AMP for connection and termination on the original equipment you purchase. For added reliability on your own equipment you can demand no less.

Standardize on AMP for generating and sub-station construction and maintenance, communication, panel and switchgear wiring, street and traffic lighting, appliance and meter repair and all other applications where terminals and connectors must produce improved quality, cost reduction and reliable service.

A-MP terminals, when required for maintenance and repair needs, are available in the U.S.A. through American Pamcor Inc. api AMERICAN PAMCOR INC.

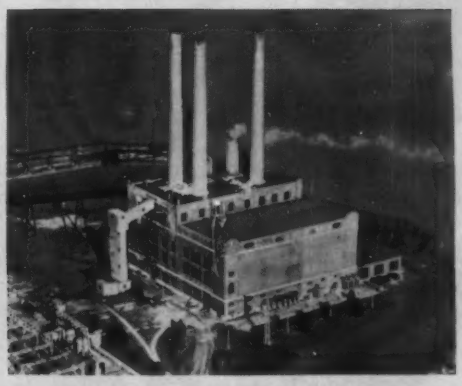


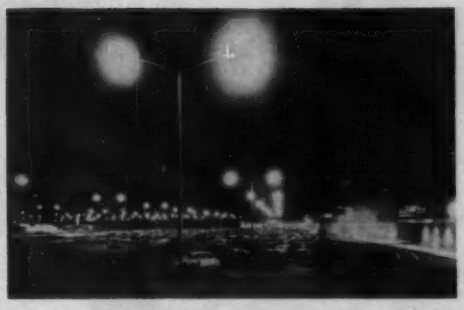
AMP INCORPORATED

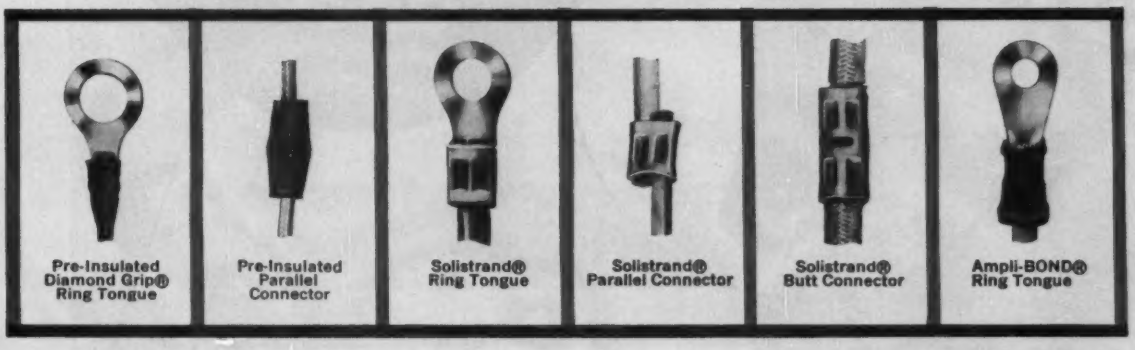
GENERAL OFFICES: 7241 EISENHOWER BOULEVARD, HARRISBURG, PA.

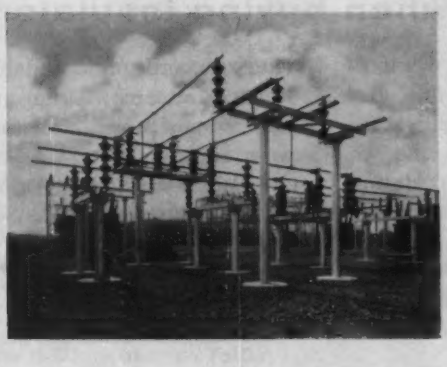
Wholly Owned Subsidiaries: **Aircraft-Marine Products of Canada Ltd., Toronto, Canada • Aircraft-Marine Products (Great Britain) Ltd., London, England • Societe AMP de France, Le Pre St. Gervais, Seine France • AMP—Holland N.V. 's-Hertogenbosch, Holland •** ***Distributor in Japan:*** **Oriental Terminal Products Co., Ltd., Tokyo, Japan**

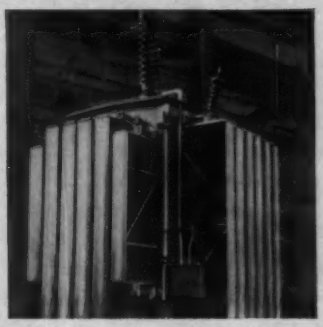
RECTION



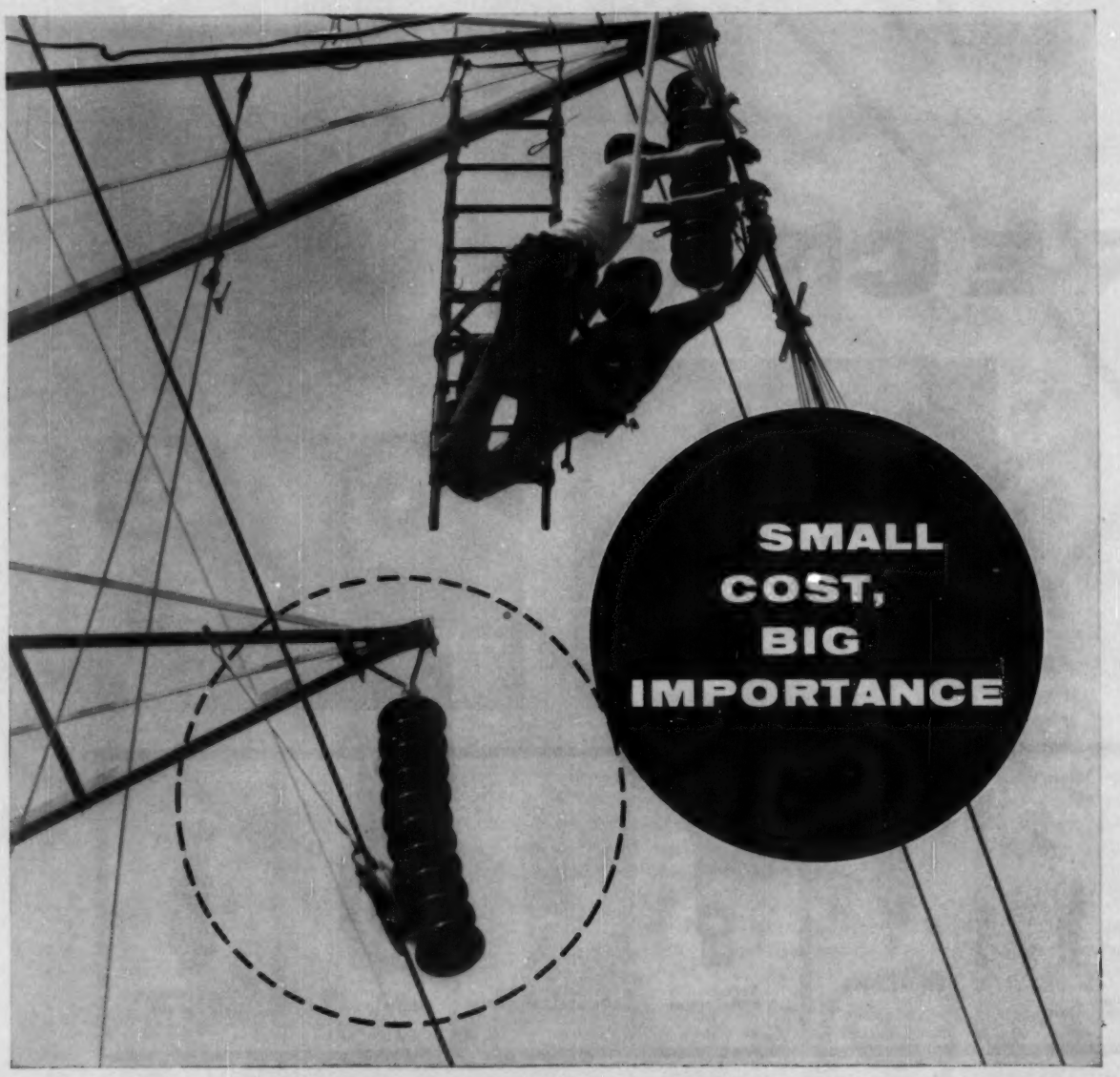



Pre-Insulated Diamond Grip® Ring Tongue
Pre-Insulated Parallel Connector
Solistrand® Ring Tongue
Solistrand® Parallel Connector
Solistrand® Butt Connector
Ampli-BOND® Ring Tongue





AMP®



so look beyond cost when buying insulators, hardware

Suspension insulators and hardware are important in operation of a transmission line, but they're a small part of the cost. In the budget for a new line, you'll find them down among the two to five per cent items. Meals and transportation usually cost more than insulators and hardware.

Viewed with this perspective, insulator price ceases to be a major consideration. Of more interest are the quality of the product and the record of the manufacturer. Whose products have the longest records of dependable performance? Who leads in research, design and production? Who understands best the relationship between hardware and insulators?

Answers to these questions point to the best insulator buy for the money, regardless of price. And they invariably point to Ohio Brass insulators and hardware.

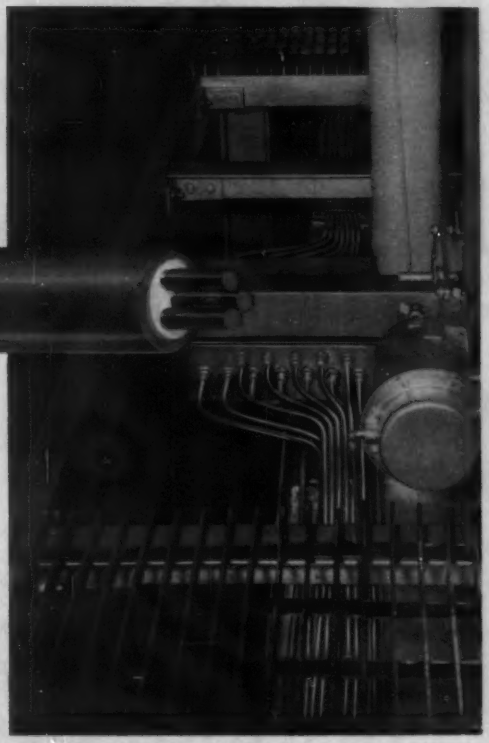
OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass

4770-H

SAFETY M.I. CABLE

the answer to industrial power wiring...



- SPACE SAVING
- Time saving
- Permanent
- INSTALLED EASILY
- Fast power wiring to cut down-time

More and more General Cable's Safety MI 600 Volt Wiring System is being used because it can take the abuse of industrial application, giving trouble-free operation and unexcelled performance under the most severe conditions. Particularly adaptable in hot and wet locations. Available in 1, 2, 3, 4 and 7 conductor for power and control circuits.

MI terminating in main Japan Oven control center switchboard at Poinsett Lumber and Manufacturing Company, Andersen, S.C.

Ask for a Demonstration To-Day!

GENERAL CABLE CORPORATION, 420 Lexington Avenue, New York 17, N. Y.

Offices and Distributing Centers Coast-to-Coast

for quality and service...specify **GENERAL CABLE**

1,200,000 HORSEPOWER AT S. MORGAN SMITH

This view of the assembly floor at SMS Plant #2 shows six (6) turbine scrolls* and other components under construction at one time. They represent over 1,200,000 H.P. for the U. S. and South America. As identified by number, they are:

	PLANT	No. UNITS	H.P.	HEAD	SCROLL
1* & 2* Idaho Power Co.	Brownlee	4	144,000	250′	18′ T-1 Welded
3* & 4* C.E.M.I.G., Brazil	Itutinga	2	20,000	98′	13′ Riveted
5* Pacific Pr. & Lt. Co.	Swift #1	3	100,000	350′	11′ T-1 Welded
6* Montana Power Co.	Cochrane	2	42,000	80′	22′ Welded
7 (Runner) Portland Gen. Elect. Co.	Pelton	3	52,200	150′	15¼′ Riveted
8 (D. T. Liner) Pacific Gas & Elect. Co.	Butt Valley	1	52,000	280′	9½′ Welded

The T-1 scrolls for Brownlee – the first plant of the Hells Canyon group on the Snake River – are the first usage in the hydraulic turbine industry of this new alloy for field welded scrolls. Swift Creek also has T-1 scrolls, which are shop welded.

Whatever your needs in hydraulic turbines and accessories, SMS offers you over three-quarters of a century's experience in design, engineering and manufacturing, plus the most modern hydraulics testing laboratory available. For full information, write to S. Morgan Smith Company, York, Pa.

More Power To . . .

S. MORGAN SMITH

HYDRODYNAMICS

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

Rotovalves • Ball Valves • R-S Butterfly Valves • Free-Discharge Valves • Liquid Heaters • Pumps • Hydraulic Turbines & Accessories

Iowa Southern Utilities gets life-of-turbine guarantee against turbine oil worries

Utility installs NONPAREIL Turbine Oil in two units at Eddyville station

On September 20, 1953, two Westinghouse 20,000 kw. turbines were installed in Iowa Southern Utilities' Eddyville station. Two guarantee certificates, covering the two 1,200 gallon fills, were issued to the utility by Standard Oil. These certificates guarantee Iowa Southern Utilities that for the life of these turbines, the NONPAREIL Turbine Oil will never exceed an acidity level of 0.15 mg. KOH/g. The utility can depend upon the level being much lower—usually on the order of 0.03-0.05 mg. KOH/g.

The significant point to this story is that it is so routine. Iowa Southern Utilities has been installing NONPAREIL Turbine Oil in turbines since 1942. In the years since then, all turbines in the system have been converted to this oil. The oil is backed up with a life-of-turbine guarantee.

Having an oil with such a guarantee permits Iowa Southern management to direct its attention to the operation of its properties without worry about turbine oil performance. Additional facts about NONPAREIL Turbine Oil are available from your nearby Standard Oil industrial lubrication specialist in any of 15 Midwest and Rocky Mountain states. Call him, or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

L. V. Hults and Jess Nelson inspect turbine oil returning to filter. Mr. Hults said, "The oil looks like new, and we've used it for four years."

Mr. L. V. Hults, Plant Superintendent (left), and Standard Oil industrial lubrication specialist, Jess Nelson, check instrument panel on one of Westinghouse turbines at Eddyville station. Jess Nelson is indeed qualified to serve accounts such as this utility. Jess has an engineering degree from the University of Iowa. He has completed the Standard Oil Sales Engineering School and has four years experience providing lubrication technical service.

STANDARD OIL COMPANY
(Indiana)

STANDARD

Copperweld* Type M Guy Strand offers double economy: 1. lower first cost, 2. lower maintenance costs. Research and new production techniques make it possible for us to manufacture Type M at savings which are passed on to you. The result is Copperweld quality costing you less than before. And the savings don't end after installation. They continue year after year because Type M Guy Strand requires so little maintenance. It will last as long as modern poles.

Seven strengths are available: 2.2M, 4M, 6M, 8M, 10M, 12.5M and 16M. Easo to handle—easy to install, Type M Guy Strand can be readily bent, served, moused or clamped. Write us today for complete information about this new product and its money-saving features.

*Trade Mark

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION *Glassport, Pa.*
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

2.2M 4M 6M 8M 10M 12.5M 16M

New Copperweld TRADE MARK
TYPE M GUY STRAND

Guaranteed for life!

All Sangamo Watthour Meters—singlephase and polyphase—have lifetime guarantee on materials, workmanship, and bearing system

The ball and jewel bearing system used for years in Sangamo Watthour Meters has been test-proven to withstand 800 million revolutions without appreciable wear. But Sangamo research has now determined that treating the cobenium ball bearing with Molykote® Microsize (the most highly purified molybdenum disulphide) will give such optimum performance that *the bearing system will never need relubrication, inspection or replacement!*

That's why Sangamo now offers an unprecedented lifetime guarantee—covering materials, workmanship, and bearing systems on all Sangamo Meters using the cobenium ball and sapphire jewel bearing system, made after October 1, 1957.

P.S. Ask your Sangamo Representative how you can use this discovery to add to the useful life of your existing meter bearing systems.

JM57-B

SANGAMO ELECTRIC COMPANY

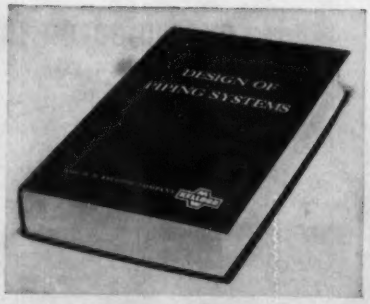
SPRINGFIELD, ILLINOIS

KELLOGG'S ERECTION TECHNIQUES KEEP PACE

K-WELD* is one of M. W. Kellogg's many advanced shop fabrication techniques which have been adapted by the company's construction department for field erection of critical power piping. A patented inert gas-shielded method of arc welding which eliminates backing rings and oxidation, K-Weld provides in field erection a smooth internal wall contour equal to that obtained under controlled shop conditions. For "average" as well as super-critical operating conditions, wherever the ultimate in welding is required, more and more power generating companies are turning to K-Weld.

A typical example is found currently in a 137,500 KW unit for a large eastern utility plant. Here, Kellogg is erecting the critical piping for the latest unit. Reheat piping, being K-Welded above, is 2¼% chrome-1% molybdenum alloy, 24.8750" OD, 1.1875" wall thickness. Main steam line is 10.906" ID, 2.410" minimum wall thickness, and 7.906" ID, 1.792" minimum wall thickness, and will operate at 1,940 psi, 1,000 F throttle temperature. For maximum performance, K-Weld is being used on both the main steam line and hot reheat line.

M. W. Kellogg welcomes inquiries on its complete service to the power piping industry from consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.



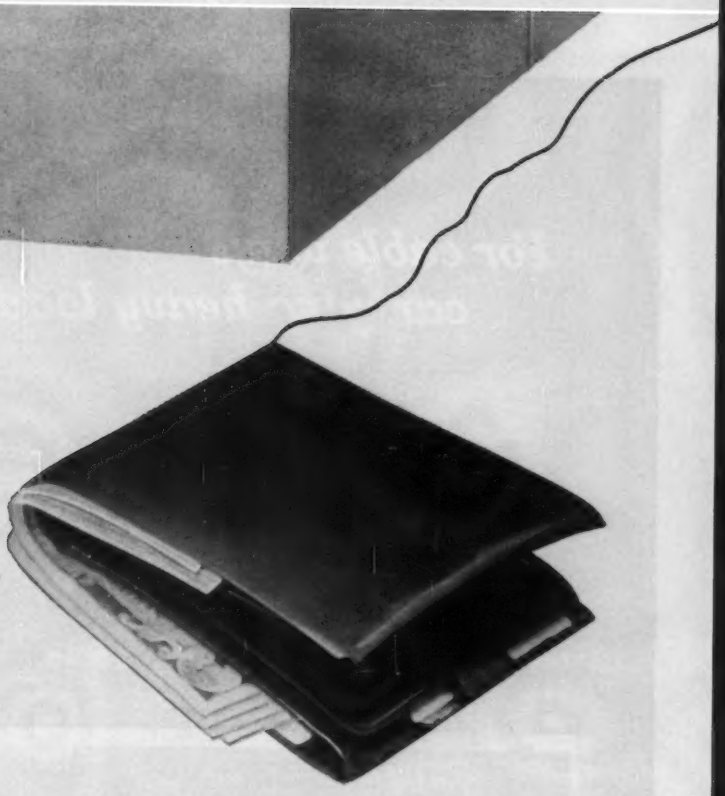
Kellogg keeps pace in theory as well as practice. This 400-page book is the most comprehensive work ever made available publicly on the design of power piping. This volume, now in its 2nd Edition, is published by John Wiley & Sons, Inc., New York.

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N. Y.
A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Company Ltd., Toronto • Kellogg International Corp., London • Kellogg Pan American Corp., New York • Societe Kellogg, Paris • Companhia Kellogg Brasileira, Rio de Janeiro • Compania Kellogg de Venezuela, Caracas

POWER PIPING—THE VITAL LINK

*Trademark of The M. W. Kellogg Company



GIVE-AWAY ...WITH STRING ATTACHED

Although many people are far too smart to fall for the old "lost wallet" trick, some still fail to see the string on the "public power" give-away. The time-honored April Fool stunt can only snatch away some money that the victim never had. "Public power" lifts his hard-earned cash right from his pocket.

What makes the "public power" issue much more insidious is the claim that the whole idea is to *prevent* a give-away: the giving away of power sites—natural resources that belong to everybody—to private power companies. The government, say "public power" advocates, can sell power much more cheaply.

And it does. Not that the government *produces* it for less—it has to pay the same costs of labor, tools, and materials that any private power company would have to pay.

But here's the string: Government power agencies are largely exempt from taxes. So are the investors in their securities. The savings in direct tax costs and finance charges enable these agencies to charge much lower rates for electric power and still show no deficit on their books.

Who then makes up the difference between what "public power" really costs and what the favored consumers pay for it? The public at large, the *taxpayer*.

Leaflets, reprints and newspaper mats available at cost for publication of this message locally over the signature of your company. Address EW-2, Guaranty Trust Company of New York, 140 Broadway, New York 15, for further information.

Thus, for each $1 paid for electricity by customers of a private power company, some 23¢ goes for taxes. But people who buy their power from TVA, for instance, get off with taxes of only about 4¢ on the dollar.

So where's the give-away?

It occurs not under private enterprise but under "public power" development as practiced today.

The thing that's given away is not natural resources but the taxpayer's money.

And the favored groups are not private power companies but customers of "public power."

One question: Why shouldn't every American pay his fair share of taxes?*

*Based on material from The Guaranty Survey, published by Guaranty Trust Company of New York.

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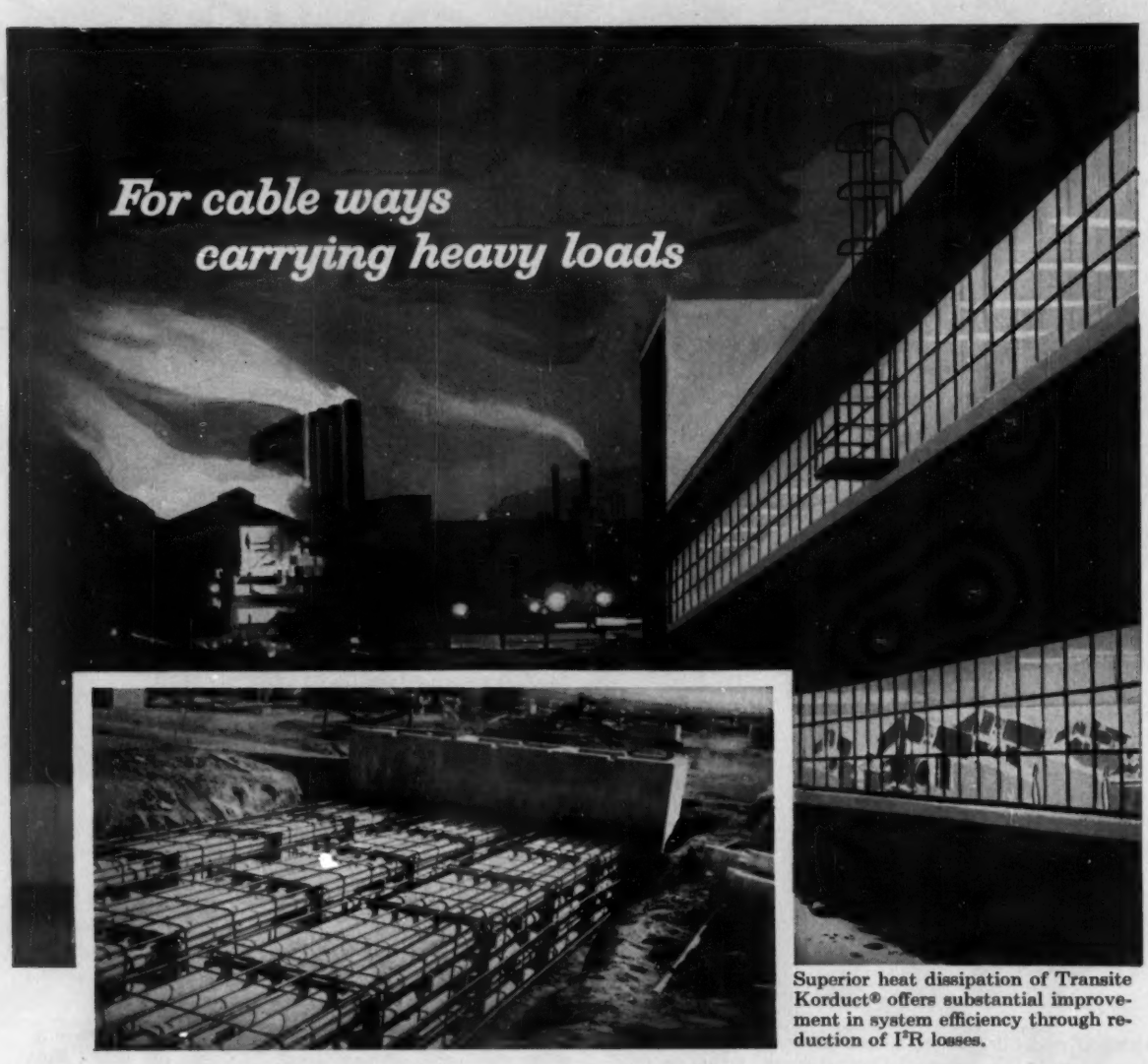

Superior heat dissipation of Transite Korduct® offers substantial improvement in system efficiency through reduction of I^2R losses.

J-M Transite® Ducts mean increased capacity—longer cable life—maximum return on investment

FINDINGS OF TESTS made at Johns-Manville Research Center and approved for presentation by AIEE Insulated Conductor Committee, show that J-M Transite Ducts dissipate heat of cables faster. The result is cooler cables under a given load . . . lower I^2R losses . . . longer insulation life from lower operating temperatures.

Transite Ducts offer many other advantages, too. Made of asbestos-cement, they are incombustible, resistant to corrosion, unaffected by electrolysis. Transite Ducts resist damage when arcing occurs. These durable, lightweight ducts provide complete and permanent cable protection, together with savings on installation and maintenance.

For complete details of tests and the many advantages of Transite Ducts, write for Brochure EL-29A, and J-M Cooler Cables story. Johns-Manville, Box 14, N. Y. 16, N. Y. In Canada: Port Credit, Ont.

Johns-Manville TRANSITE Asbestos-Cement DUCTS

J-M CONDUIT for direct buried banks and exposed runs—J-M KORDUCT® for concrete banks

BE SURE YOUR LINEMEN KNOW the

DO'S and DON'TS for INSTALLING TENSION SPLICES

For Thoroughly Efficient Installation of TENSION SPLICES

FREE . . . As Many Copies as You Need

to hang where your linemen can see them. This 17" x 22" two color poster carries no advertising . . . It is issued as a service to the industry.

WRITE FOR YOUR SUPPLY TODAY!

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A HALF CENTURY OF SERVICE TO THE UTILITIES

A BOLD NEW CONCEPT

IN DISTANCE RELAYING . . . K-Dar

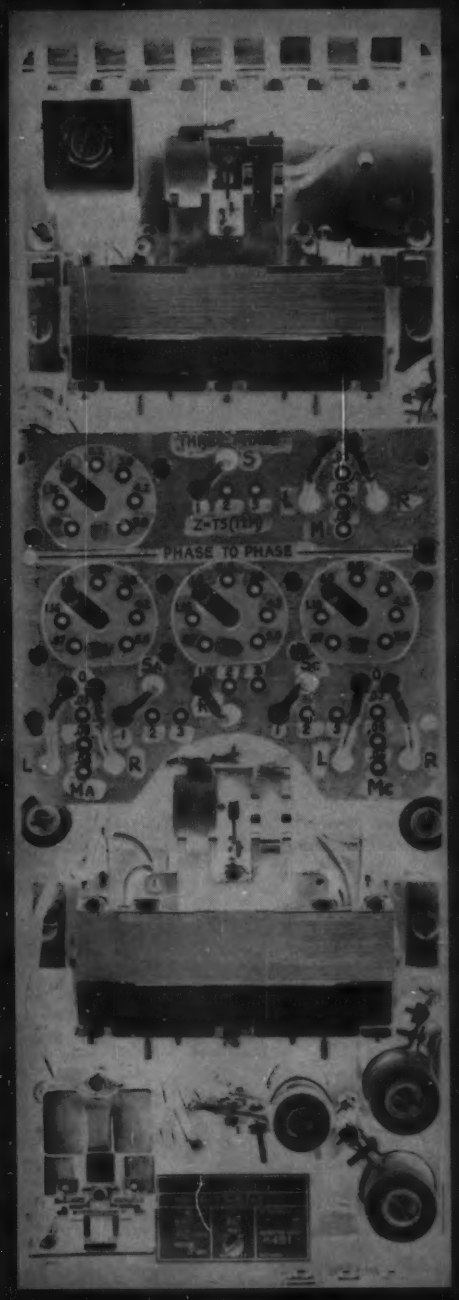
To provide the increased phase fault protection and system continuity so important on today's transmission lines, Westinghouse developed a completely new technique for high-speed directional distance relaying.

Central intelligence of this new K-Dar relay system is an air-gap transformer that serves as a compensator . . . making the relay system insensitive to d-c transients. The increased relay accuracy thus gained permits considerably more line coverage and a new high in system stability. Individual relays in the K-Dar system also provide complete three-phase protection in a single zone. These high-speed relays have a range from 0.75 to 20 ohms.

The K-Dar system was engineered as a coordinated unit with the new, completely transistorized Westinghouse KR carrier. Working as a team, they provide instantaneous tripping of relays on both ends of a faulted section . . . for 100 percent coverage of the line.

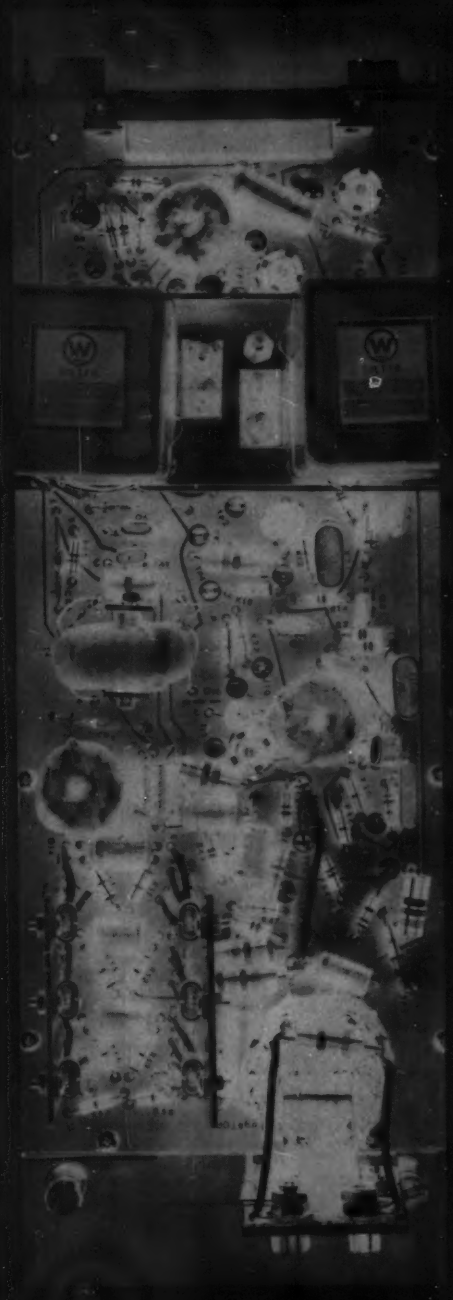
For complete information about the extra protection K-Dar carrier relaying can offer your system, call your Westinghouse sales engineer or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40502

YOU CAN BE SURE... IF IT'S Westinghouse



K-Dar DISTANCE RELAYING

Number of moving parts cut in half. Phase-to-phase settings reach further because relays operate independent of load current or system swing.



KR TRANSISTORIZED CARRIER

KR ends tube replacement. Cooler operation longer life for all components. Besides top reliability, KR uses 1/10 power, needs 1/20 space of conventional equipment.

CLOSEST TOLERANCES!

You get insulating parts as accurate and as uniform as men and machines can make them, when you specify Macallen Mica. More than sixty years of Mica specialization is your guarantee. The result? Assembly speed that cuts your costs!

SEND FOR CATALOG!

It covers the most complete line of mica insulating products available from a single source.

THE MACALLEN COMPANY

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SPECIFY **MACALLEN MICA**

FOR THE MOST IN MICA

SAFETY SWITCHES STAND UP UNDER 100,000 AMPERE SHORT CIRCUIT TEST!

INDEPENDENT TESTING LAB RELEASES FINDINGS AFTER GRUELLING "TORTURE RACK" TESTS

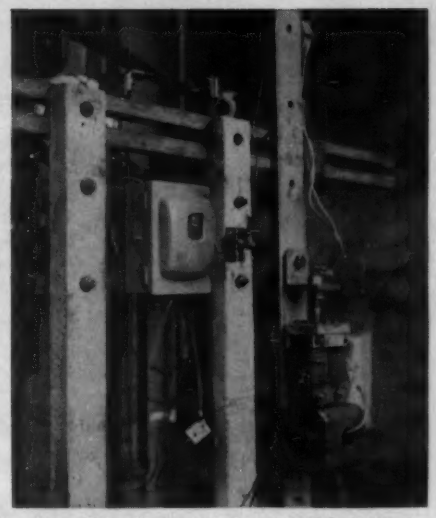
Unprecedented tests have been completed on 30 through 600 ampere rated Square D safety switches equipped with high capacity current limiting fuses. During these tests, switches were closed on a short circuit system delivering up to 100,000 amperes (symmetrical—R.M.S.). In addition, the fault was applied on the closed switches. *All switches withstood the shocks without any sign of failure!*

High Capacity Systems Demand Stamina

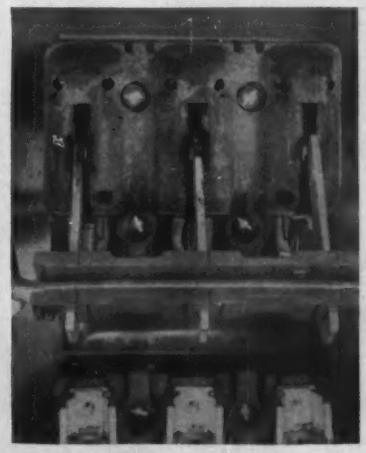
High capacity systems capable of delivering tremendous short circuits are becoming more and more prevalent with the growth of electrical loads. Network systems in metropolitan areas are a source of such faults. Another, the heavy industrial areas, with a concentration of sub-stations and rotating machinery. Terrific stresses and heat generated by such faults are serious hazards to both personnel and equipment unless properly contained. That is why proven protection for switching service and feeder circuits is of major concern.

Square D Standard Switches Do The Job

These tests offer conclusive proof that standard Square D Type HD and Type ND switches, equipped with high capacity current limiting fuses, can be used on such systems without fear of failure. You pay no premium for the proven performance they offer. Why settle for less?



Square D switch on "torture rack" during test involving up to 100,000 ampere short circuit



SUMMARY TABLE • Extract from Report No. S/NA R66—Sheet No. S

Ampere Rating	Voltage Rating	Catalog Number	Average Symmetrical Prospective Current R.M.S.	Recovery Voltage R.M.S.	Maximum Total Arcing Time	Fuse Type
30	250	A85351	96,600	252	.0009	A2Y-30A
30	250	A85351	96,400	253	.0010	FRN-30A
30	600	A85341	107,000	590	.0020	A6Y-30A
30	600	A85341	106,000	601	.0027	FRS-30A
60	250	A86352	96,400	248	.0010	A2Y-60A
60	250	A86352	95,200	252	.0019	FRN-60A
60	600	A86342	106,000	605	.0011	A6Y-60A
60	600	A86342	108,000	598	.0020	FRS-60A
60	600	A86342	107,000	601	.0013	NAS-60A
100	250	A86353	95,200	253	.0009	A2Y-100A
100	600	A86343	108,000	604	.0014	A6Y-100A
200	250	A86354	95,200	253	.0037	A2Y-200A
200	600	A86344	107,000	602	.0011	A6Y-200A
400	250	A86355	95,900	252	.0039	A2Y-400A
400	600	A86345	106,000	611	.0050	A6Y-400A
600	250	A86356	94,500	251	.0062	A2Y-600A
600	600	A86346	107,000	601	.0062	A6Y-600A

Above • Extract of Nelson High Power Laboratory Report C/NA-66

At left • No sign of failure in this switch interior after 100,000 ampere short circuit test

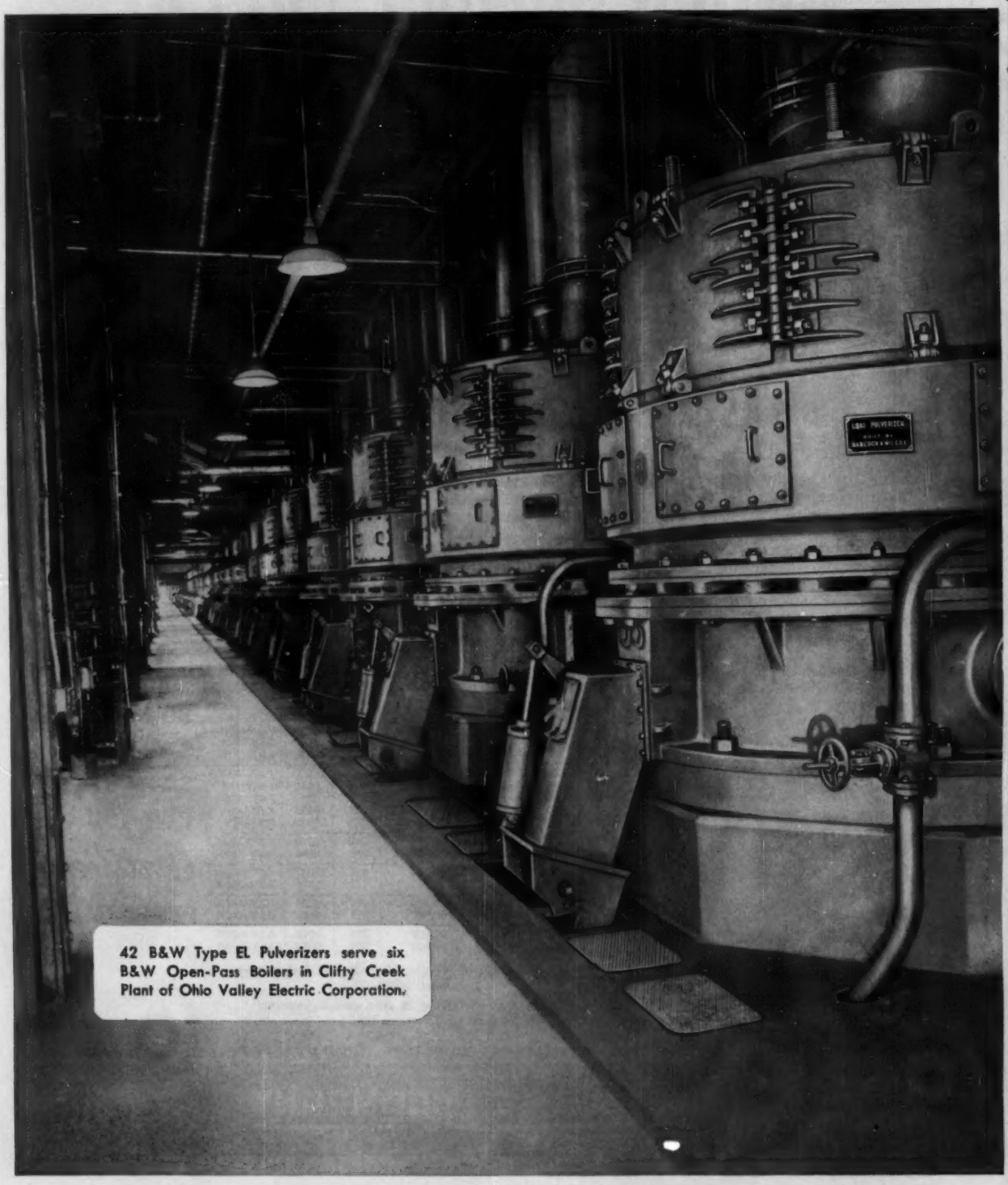
SQUARE D SAFETY SWITCHES GIVE YOU *Certified* PERFORMANCE!

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

Have You Investigated

THE MODERN B&W



42 B&W Type EL Pulverizers serve six B&W Open-Pass Boilers in Clifty Creek Plant of Ohio Valley Electric Corporation.

DIRECT-FIRING SYSTEM?

A Compact, Space-Saving Package of Efficient Grinding Power

More power and capacity in a compact arrangement . . . long-range dependability . . . reduced operating cost — these are the measurable results of continuous, intensive development of the modern B&W Pulverizer. It has established an outstanding production and efficiency record in thousands of commercial installations. Here are some reasons why:

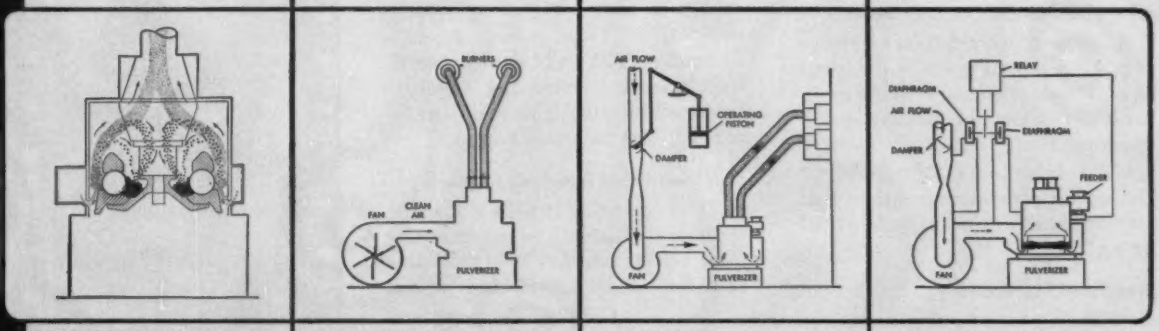
Continuous High Fineness Over Entire Service Life: Efficient combustion requires high fineness at all times. The high circulating load of the B&W Pulverizer permits efficient and dependable classification of product, so that only material of proper fineness leaves the unit. In addition, its slow-speed, spring-loaded ball bearing grinding elements maintain proper grinding contact throughout their service life.

Handles Wide Variety of Low Grade and Wet Coal: Regardless of the coal's grade or whether it's dry or soaking wet, the B&W Pulverizer's unique and exclusive recirculation of fuel through heated air assures efficient grinding . . . eliminates shutdown, capacity loss, or special attention from operators.

Simplicity of Arrangement and Reduced Maintenance: Accessibility for all normal maintenance makes it simple, quick, safe and low-cost. Adjustments are easily made while the unit is in operation. Using only clean primary air supplied under pressure, fan maintenance is substantially reduced and fuel piping is greatly simplified. Also, with the pulverizer acting as its own distributor, no special distributing devices are needed. Grinding elements are of special alloy material. They last two years or more on eastern coals and at least a year on midwestern coals.

Adaptable to All Types of Automatic Controls: Because it features "one point contact with the boiler," operation of the B&W Pulverizer is simple. The boiler's automatic combustion control is connected to the pulverizer at only one point—the damper in the primary-air duct. The pulverizer's own control system regulates all other functions, such as maintenance of proper fuel-air ratio and operating temperature.

SEND FOR DATA. For full information about the B&W Type EL Pulverizer and Pulverized-Fuel Firing Systems, write: The Babcock & Wilcox Company, 161 E. 42nd Street, New York 17, N. Y.



COAL RECIRCULATION — this means high fineness, aids drying.

PRESSURE SYSTEM — this eliminates fan wear, simplifies piping.

AIR CONTROL—this means one, simple control contact point.

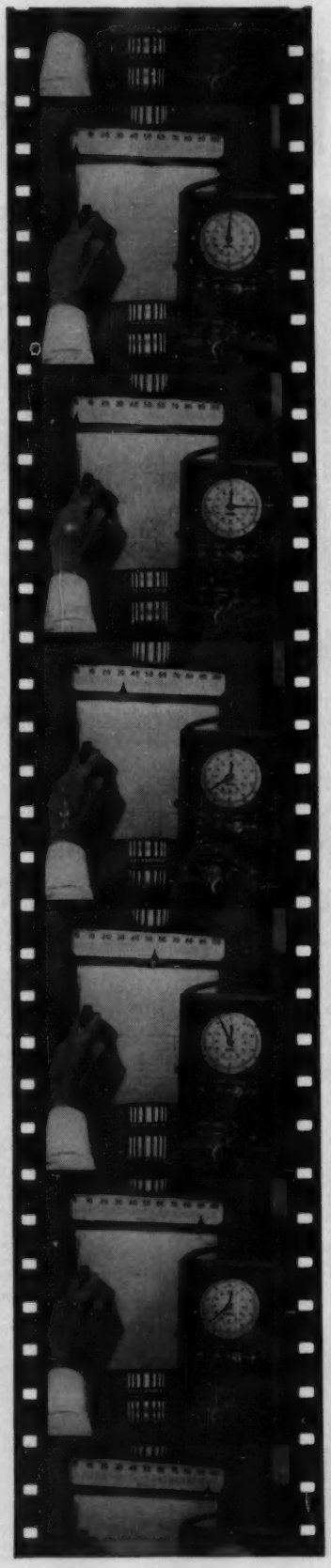
MILL LEVEL CONTROL — this automatically adjusts fuel-feed.

BABCOCK & WILCOX

BOILER DIVISION

O-766

Another L&N solution to the area regulating problem



These movie films show how fast a simulated full-scale, instantaneous load change is detected, transmitted hundreds of miles, recorded and fed into the load control: at top, a plunger switch triggers the system's primary element, and starts a 1 rps time standard. Subsequent frames show how receiving recorder whips across scale to record 90% of the full-scale change in 1.65 seconds.

New Telemetering puts 90% of full-scale load change on chart paper in 1.65 seconds. Developed by L&N, it's...

Something that's never been done before

Written by W. M. Richardson, Field Engineer, Leeds & Northrup Co.

These movie frames tell the story: the new Speedomax® Variable-Frequency Telemetering System starts feeding remote system data to the control center in less than three *tenths* of a second . . . actually records 9/10 of a full-scale, instantaneous load change in 1.65 seconds.

Already in operation on a number of power company systems, the speed of these new telemeters results in remarkably improved automatic dispatching control. As one operator said, "Automatic control pulses start hitting our generators less than half a second after the inception of a load swing."

Unmatched 1% Accuracy

Greater speed is only the beginning: mean accuracy (*including* end devices) is 1%. This figure does not assume ideal conditions, but is maintained within 107- to 127-volt line variations, ±15 C ambient temperature changes and 59.8 to 60.2 cycle frequency swings. On systems where transmitting-end recorders (optional) are used, sending and receiving chart curves are virtually congruent. This kind of photographic accuracy is especially important on systems contemplating computer-control, for system regulation can be no better than the accuracy of computer input data.

No Drift

Extensive field tests demonstrated that overall telemetering stability holds to within 0.5% per month without the need for recalibration.

Uses Lowest-Cost Telephone Channels

Normal operation is with a new 18-30 cycle oscillator. The new Speedomax Telemeters may also be delivered for use on leased lines where

Continued on page 116

A 35-minute 16mm sound film in full color demonstrating the correct systems of fire protection for special hazards

Produced by one of the oldest companies in the fire protection field, "Fire Protection Through Research" is a highly informative and interesting 16mm film. It takes you behind the scenes; explains the basic facts about fire; and then shows you how Grinnell, through research and engineering, has put this vital knowledge to practical application in the control of fire.

From a front-row-center seat, you can see both oil and gasoline fires intentionally set and allowed to gain full headway . . . watch them snuffed out in seconds with a variety of extinguishing agents.

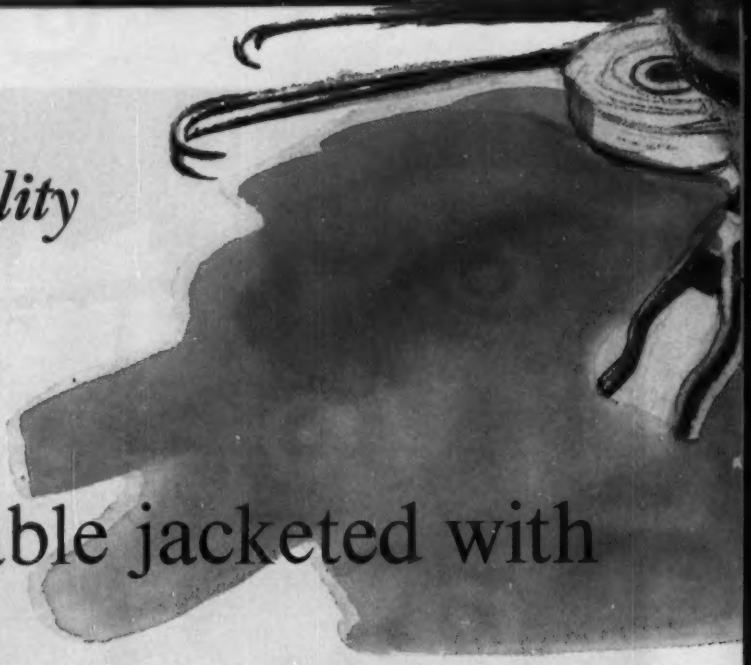
Arrange a group showing of this film among interested personnel in your organization. There is no cost or obligation. To obtain a print, write directly to Grinnell Company, Inc., 277 West Exchange Street, Providence, Rhode Island.

GRINNELL

WHENEVER FIRE PROTECTION IS INVOLVED

GRINNELL FIRE PROTECTION SYSTEMS INCLUDE: • Automatic spray sprinklers—wet pipe, dry pipe, and Simplex systems • Deluge systems with automatic detection—Multitrol or Multimatic Systems • Emulsion and vapor dilution extinguishment—Mulsifyre and ProtectoSpray systems • Water spray for cooling, insulation, and controlled burning—ProtectoSpray systems • Air foam blanket—ProtectoFoam systems • Carbon dioxide systems • Dry chemical systems

Remarkable durability



Power cable jacketed with a Du Pont ALATHON®
POLYETHYLENE RESIN

has outstanding strength and abrasion resistance

Jacketing of ALATHON 4 polyethylene resin has remarkable toughness and strength . . . outstanding resistance to abrasion, moisture and weathering. Because of this, power cable jacketed with ALATHON 4 gets maximum protection and has long service life. In addition, ALATHON's high crystallinity makes it an excellent jacketing material for use where high temperatures may be a factor.

For primary insulation, ALATHON 3B polyethylene resin is recommended. It has a low power factor and low dielectric constant, thereby keeping energy losses at an economical minimum.

Du Pont has established a family of ALATHON polyethylene resins, each suited to a range of insulating and jacketing applications. Consult with your supplier. He will be happy to explain the advantages of wire and cable construction utilizing an ALATHON tailored to meet your specific requirements; or write to E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 48-11-11, Wilmington 98, Delaware.

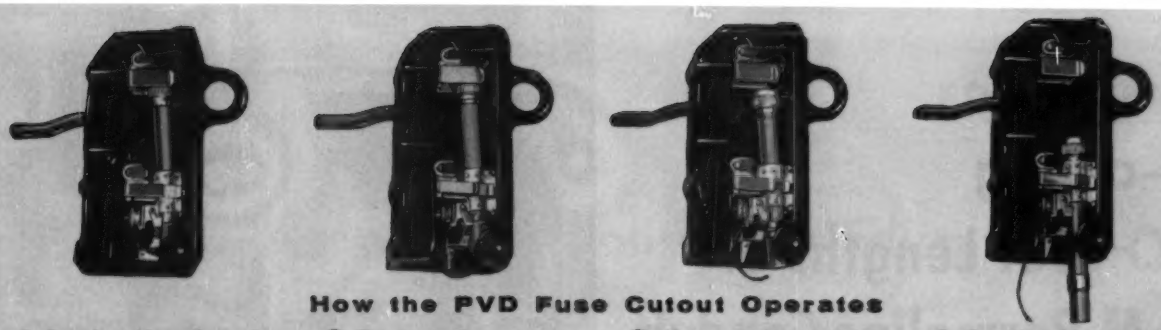
Watch the Du Pont Show of the Month—Ninety minutes of the best in live television—CBS network.

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

DOOR IS EASY TO OPEN. Handle is high up on the door to assure good leverage, and hole is large enough to insert hookstick easily, yet small enough so hook will not slide down or jump out. Available in standard-duty ratings and new heavy-duty interrupting ratings of 5000 amps. at 5.2 kv and 8000 amps. at 2.6 kv.

THE DOOR IS REMOVED, unhooked, and replaced, all with the hookstick. A special hook on the door assembly makes this convenient.



How the PVD Fuse Cutout Operates

1. Fused position. Door always closed—operation is independent of door. As the link blows, spring-loaded lever flips out the fuse link leader—fast!

2. This instantly separates blown link parts, clearing the arc inside the tube. It also releases a latch which permits the bright yellow fuse tube to drop out.

3. Upper spring contact pushes the tube down and follows it part way, giving extra time to clear the arc, and eliminating burning of contacts. Action is positive.

4. Cartridge drops to indicating position easily seen from the ground. Large air gap prevents re-establishing the arc. No leakage, no radio interference.

How L-M's Famous PVD® Cutouts Provide Faster, Safer Operation

Positive dropout operation provides indication easily seen from the ground. For re-fusing, door is easily removed and replaced with hookstick; high-pressure silver contacts insure long life. Now also available in heavy-duty designs.

By **GEORGE W. COOPER**
Product Manager
Protective and Power
Switching Equipment
Line Material Industries

When a fuse blows in L-M enclosed dropout cutouts, a latching lever flips out the fuse and permits the cartridge to drop to indicating position. Upper contact spring follows tube part way, giving extra time to clear arc inside the tube. Contact spring also provides a downward thrust on the tube to assure positive dropout operation.

The large air gap which results between the tube and the upper contacts on the box prevents re-establishing of the arc. This assures long service, eliminates leakage and possible radio interference. Door remains closed following fuse operation; parts are always protected.

Positive Low-Resistance Contact

L-M's silver-plated spring contacts and round blade provide a very high-pressure, multi-point contact surface. In addition to the side contact clips, the spring-top clip provides additional contact and current path.

L-M's heavy contact construction provides ample metal to conduct heat away rapidly from the multi-point contact surface. This results in cool operation, and resistance is kept low.

Blown Fuses Easily Located

When the cartridge in L-M's enclosed cutout is in indicating position, it is easily seen from the ground—from any angle. The lineman locates the blown fuse quickly; thus he saves operating time and restores service faster.

Easy To Re-Fuse With Hookstick

The pull ring handle on L-M's PVD cutouts is high up on the door to assure good leverage when operating the door. This, plus a hook on the flipper assembly, make it easy to open and unhook the door, and to replace it with a spare fused door, the whole job being done with the hookstick . . . in just a few seconds.

In the open position, all parts of the door and cartridge assembly are electrically dead.

When the door is closed, the two hinges and the lower contact hold the door and cartridge assembly firmly. This, plus the guiding action of the top contact, assures that the door will close properly every time.

L-M Family of Dropout Indicating Cutouts

Interrupting Capacity Amp.	5.2/2.6 kv		7.8 kv	
	50 Amp.	100 Amp.	50 Amp.	100 Amp.
2000/3000	PVD			
3000/5000		PVD		
5000/8000	PHV*	PIV*		
2000			PVD	
3000				PVD

**New heavy-duty ratings*

In addition to the dropout indicating cutouts above, L-M offers a complete line of non-dropout indicating and non-dropout fuse cutouts.

Ask your L-M Field Engineer for more complete information, or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ont.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY
fuse cutouts and fuse links

318

McGRAW EDISON

L-o-n-g 10-Foot Lengths of L-M Permaline Conduit Save Time, Labor for PEPCO

•••Three 13.2 KV feeders and 32-duct secondary service to 452-apartment building handled with 4-inch L-M Fibre Conduit.

•••10-foot lengths cut number of couplings to be connected on the job.

Potomac Electric Power Company has just installed underground electric service to a new, all-electric, 452-apartment building in Washington, D. C. Long 10-foot lengths of Permaline fibre conduit were used to speed installation of three 13.2 kv feeders and a 32-duct secondary service.

Service is 120/208 volts, three-phase, four-wire for lights and miscellaneous power, from three 500 kva network transformers, and 265/460 volts for air-conditioning compressors, radial from two transformers. The 120/208 volt service has 16 cables per phase of 500 MCM 1/c non-lead 600 volt cable, and four neutral cables of 500 MCM bare copper.

Fast, Labor-Saving Installation

L-M Permaline conduit is light, easy to handle, easy to install. Joints are quickly and easily made by simply tapping the tapered coupling onto the tapered end of the conduit. Joints are watertight and safe from seepage of wet concrete.

Long lengths and easy method of joining L-M Permaline fibre conduit also permit use of narrow trenches. This results in savings in cost of concrete and man-hours required to dig and backfill the excavation.

Complete Accessories

L-M Permaline fibre conduit is made in 5, 8, and 10-foot lengths. Available diameters are 2, 3, 3½, 4, 4½, 5, and 6 inches. L-M offers a complete system for conduit installations. Accessories include bends, bell ends, adapters, couplings, and base and intermediate spacers.

Get Complete Information

Ask the L-M Field Engineer for a copy of the 12-point plan folder which shows how easy it is to use the Permaline system; and L-M's unique Underground Construction Handbook, which gives complete specifications. Or write Line Material Industries, Milwaukee 1, Wisconsin.

POTOMAC ELECTRIC POWER COMPANY crew installs secondary run of Permaline conduit from apartment building to manhole. L-M's extra-long 10-foot lengths of Permaline conduit speed installation. Permaline is light, easy to handle, and easy to install.

THIRTY-TWO RUNS of 4-inch Permaline fibre conduit, encased in concrete, were installed by PEPCO to serve 6,700 kw load in new apartment building. L-M Permaline conduit has a smooth inner bore; cable is easy to pull and sheath is not cut or marred.

324

LINE MATERIAL Industries

MCGRAW-EDISON COMPANY

McGRAW EDISON

Permaline Fibre Conduit

BPI

This seal is your guarantee of recognized quality in Bituminous Fibre Conduit.

Self Preservation—Political or Educational

Union dues can be used for a political telecast under the guise of an educational project in the field of political science, according to a recent Detroit federal court decision. The telecast referred to here was sponsored by the U A W and consisted of interviews of Democratic candidates for state and federal office by Walter Reuther. The court said that such a program was not "in connection with federal elections which would have made the expenditure illegal." But regardless of the connection with a federal election, we can be sure that the program was intended to secure or gain the things which unions favor for insuring the preservation of their political and economic strength.

Along this same line, the Federal Power Commission decided recently that "a utility is entitled to include in its costs a reasonable amount for advertising purposes, and up to a certain point the size of the amount lies in the discretion of management." This decision which was dated October 17, 1957, involved the Tennessee Gas Transmission Co.

In an earlier decision of the Federal Power Commission involving charges to operating expense for a pamphlet "Turn on the Light", the Commission ruled that "expenses in connection with the pamphlet are political expenditures and are not properly chargeable to the utilities' operating expenses as a cost of rendering electric service."

The pamphlet "Turn on the Light" presented arguments against the construction and operation of electric power facilities by the federal government. The Federal Power Commission ruled that a dispute of public power versus private power insofar as it affects the federal government is a matter of public policy to be determined by the Congress and is a political controversy.

It is regrettable that the Federal Power Commission is not as sensible in its decisions as is the court in Michigan. In the first case, the FPC implies that management does not have full control over advertising expenses beyond a certain point.

In the second case, they fail to picture the public power versus private power matter as one in the field of political science but treat it merely as a political controversy.

These are but little skirmishes in the preliminaries of the big battle that is before us. The right to submit arguments in the field of political science should be available to everyone. The right to present arguments to preserve unions and corporations is basic and should be a justifiable expense in either instance.

The utility industry may lose this right by default if individual companies, along with the industry as a whole do not fight for the basic principle in every instance. The precedent set by a few who might give in to pressure from the Internal Revenue Department or the Federal Power Commission may set a pattern which others will be forced to follow. Now is the time to fight the battle for self preservation by political or educational means.

ELLIS: Enough "money to kick in?"

Co-ops Explore Anti-Trust Suit Against Private Utility Groups

Regional co-op organization adopts resolution to study advisability of prosecuting. They'd base the case on result of truckers suit against railroads and PR firm

Under the guiding hand of its shrewd leader, Clyde Ellis, a regional delegation of National Rural Electric Cooperative Assn members early this month adopted a resolution to study the pros and cons of an anti-trust suit against privately owned electric utility companies, their organizations and public relations firms.

Ellis, general manager of NRECA, said he wasn't advocating such a suit but he wanted to know if there were enough co-ops with "money to kick in" for such a purpose.

The action came at NRECA's Region 9 meeting in Portland, Ore., on Nov. 4-5. It closely followed reports of the decision on the anti-trust suit of the Pennsylvania Motor Truck Assn vs. eastern railroads. The railroads and their public relations firm were found guilty of violating the Sherman Anti-Trust Law by a Philadelphia U. S. District Court judge.

The resolution adopted in Portland asks NRECA to "explore immediately the possibility and advisability of prosecuting a similar case against the power companies which are attacking us and their organizations and public relations firms."

A Matter of Timing

Later, the NRECA said in Washington that the resolution has been adopted only at the Portland session. It was not brought up at other regional meetings because, at the time, the truckers' case hadn't been completed, the NRECA stated.

Next step will be either NRECA board action or a similar resolution that might be acted upon at the group's national meeting in February. NRECA spokesmen declined to tell Electrical World just what they definitely plan to do before the meeting.

Informed sources at one private power company organization said they don't think NRECA has a case.

The adopted resolution reads: "Competent counsel has indicated that in its opinion a close similarity exists between the facts of this (trucking *vs.* railroads) case and the propaganda campaign of the power companies against the rural electric cooperatives, the power districts, the municipally owned electric systems and their organizations . . ."

Basis for 'Similarity'

In citing the Federal Court decision, in favor of the trucking association, the Portland resolution includes these excerpts from the judge's decision:

"The base of the pyramid of accomplishment on the part of Byoir (the public relations) firm for the railroads was the arousing of resentment in the ordinary citizen against the truckers. To this end, Byoir shrewdly chose the obvious shortcomings of the trucking industry and by use of dramatic segments of truth distorted them into complete falsehoods. While Byoir chose the appellation of third-party technique (including front organizations) for its activities, I prefer to treat the whole procedure in its true light, which is the technique of the 'Big Lie.'

"The loss of business suffered by and expense entailed to each and every plaintiff and the industry as a whole in counteracting the undermining of public confidence was tremendous and quite obviously resulted in higher costs to the consumer. This in and of itself is a sufficient injury to support the cause of action."

Judge Thomas J. Clary handed down the decision. He sustained the trucking group's treble-damage suit for $250 million and also dismissed a $120-million counter suit against the association and 40 long-distance truckers. The individual truckers were awarded nominal damages of 6¢ each, trebled. They were legally injured by the conspiracy, the judge ruled, but they could not recover actual damages sustained by an executive act—a veto of "fair truck legislation" in 1951.

Who'll Serve Servicemen's Houses?

Some utilities object to proposal that government buy distribution facilities to Wherry housing on military bases, although loss in revenue may be small

The government wants to buy Wherry housing at military bases to wipe out competitive inequity with Capehart housing. Along with this, the Dept of Defense wants to buy from private utilities the distribution systems serving some of the houses.

If negotiations with utilities go without a hitch, an estimated 50,000 customers at 60 bases may have their electricity supplied by the base. This means that many utilities now serving military housing on the regular residential rate may instead have to sell more block power to the military bases at bulk rates.

Most affected utilities feel that this program would result in little change in revenue. In a few cases they are already supplying kwhr at bulk rates to the private owner of a Wherry housing project.

Furthermore, Defense Dept says, experience has shown that where residents (service personnel) don't pay their own power bills their consumption of power increases. Furthermore, they say defense is obligated to equip all houses with various appliances which in many cases don't exist now. This will also increase power consumption.

But as to outright sale of residential distribution facilities to military bases, some utilities are objecting strenuously. In answer to a government request for the cost of their facilities, one utility wrote that "the figure (given) is not an indication of willingness to sell, nor do we intend to sell."

"Violates Free Enterprise"

In an EW interview a spokesman for another large utility felt that the government move was a violation of the free enterprise system in that it put the government in competition with private business. Despite the fact that their losses in rates would be negligible, the spokesman felt that it was more properly their domain to keep providing the service regardless of who owned the housing.

The Defense Department now is in the process of attempting to formulate a standard policy for all the services to follow in negotiating with utility companies.

No pattern has emerged yet. The Air Force has completed two utility contracts: one with Illinois Power Co involving acquisition of existing facilities and a new rate, the other with Gulf Power Co.

Reason for the situation is this: Under recent changes of law made in Congress the Defense Dept is required to purchase, under certain conditions, houses at military bases. They are known as "Wherry Housing" after the late Sen Kenneth Wherry (R-Neb.) who sponsored the law that led to their construction.

Wherry Houses originally were built by private contractors with private money on land frequently leased from the government. Service personnel occupied the houses and paid rentals out of their quarters allowances to the private owner.

Under more recent changes in law, new housing for service personnel is built under the Capehart formula—named for Sen Capehart (R-Ind.)—under which the Defense Dept is the owner.

Congress has ruled that where there is this conflict, Defense should buy out the Wherry projects.

Under the previous arrangements at most Wherry housing utility services were supplied just as they are to civilian housing.

Now where the Wherry housing will be taken over, the Defense Dept will assume responsibility for the supply of electric service and other utilities, and this is where the change is about to come.

Could Switch to Federal Power

Trouble may come in cases where utilities are not prepared to furnish service at bulk rates. Base might then negotiate with a competitive source for service. Such a source could be a federal power project, or other public power agency.

U. S. has bought Wherry Housing at these bases:

Air Force

- Chanute, Illinois, 800 housing units.
- Eglin, Florida, 750 units.
- Robbins, Georgia, 500 units.
- Holoman, New Mexico, 600 units.
- Hill, Utah, 350 units.
- Fairchild, Washington, 1,000 units
- Travis, California, 980 units.
- Sewart, Tennessee, 600 units
- Briggs, Texas, 800 units
- Malmstrom No. 2, Montana, 400 units
- Tyndall, Florida, 450 units
- Stewart, New York, 284 units.
- Presque Isle, Maine, 192 units.

Army

- Redstone Arsenal, Alabama, 120 units
- Fort Eustis, Virginia, 412 units
- Ft. Lee, Virginia, 300 units
- Ft. Ord, California, 1,000 units
- Ft. Bragg, North Carolina, 2,000 units

Navy

- Two small radio station operations in Virginia totaling 40 units
- Port Hueneme, California, 326 units

'Power-Up' to

Left to Right: A. A. Berard, Mark W. Cresap, Jr. and A. C. Monteith

Industry must "Power-Up" and "electromate" with 585 billion kwhr by 1965 if national output is to outpace the steadily increasing labor shortage, A. C. Monteith, Westinghouse vice president—apparatus products, told the National Electrical Manufacturers Assn last week at its annual meeting in Atlantic City, N. J.

To help make this automation possible, equipment manufacturers will have to raise prices, Mark W. Cresap, Jr., executive vice president at Westinghouse, told the association. "We cannot assure the long-term health of our industry unless we receive fair prices for our products," Cresap said, "prices which permit reasonable profits—profits which enable us to support our research and development tradition, to generate funds for physical expansion and improvement, and to remain attractive to the investing public."

Power-Up for the Future

"By our historic balance of the number of workers to the number of people to be supported we've been accumulating a worker deficiency," Monteith stated. "Over the last eight years, we have been 11-million workers short. In another five years, this deficiency will be 15 million," he predicted.

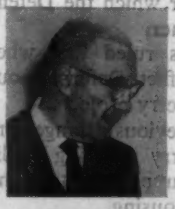
"How then are we to support our population, hold our position among the nations of the world and still continue to increase our standard of living?" The answer, he said, is to step up the productivity of the individual worker, to "electromate."

If manpower remained level, Monteith said, a 30% production increase would require 70% more power. "Now everyone predicts that we'll need not 30%, but 40% increase in production by 1965 to meet all the demands. So you can begin to see why the forecasts say we're going to need 585-billion kilowatt hours of electrical energy by 1965 for industry alone if we hope to maintain our standard of living and our place among the nations of the world."

Yet every one of 550 important plants recently surveyed was underpowered in the light of these needs, he said. "What good are all these dreams of electromation and increased output per worker," Monteith asked, "if the very energy that is going to make all this possible can't even get in the front door?"

In calling for more realistic pricing, Cresap noted

NEMA Officials Elected



President

W. V. O'Brien, VP and general sales manager, Apparatus Sales Div, General Electric Corp, succeeds President A. A. Berard.

Vice-President

A. D. R. Fraser, president, Rome Cable Corp, is another new vice president. He hails from Rome, New York.

Vice-President

Frank H. Roby, vice president—sales, Square D Co, is also a new NEMA vice president. He lives in Detroit.

Vice-President

J. C. Sharp, president and general manager, Hotpoint Co, Div. of General Electric Co., is a new vice president.

Treasurer

B. C. Neece, president, Landers, Frary and Clark, has been elected to succeed F. F. Loock as NEMA treasurer.

Offset Labor Dearth, NEMA Hears

- "Electromation" can raise productivity despite the labor shortage. But industry is underpowered now, will need 585 billion kwhr by 1965
- Cresap calls for higher equipment prices to bolster shrinking profits
- O'Brien is new NEMA president, and B. C. Neece is treasurer

that earnings of the electrical equipment industry from 1952 through 1956 have declined steadily because costs have risen faster than prices. During these years the electrical equipment industry slipped from third to eighth place in rate of return, out of the 22 industries classified by the Dept of Commerce. Using pre-tax profits as the measure, stock holders' equity in the industry has declined 25% from 1952 through the first half of 1957. And over the past five years earnings plus depreciation have failed to equal capital expenditures "by a considerable extent."

Despite this pinch, Cresap pointed out, the electric equipment industry has continued to increase research expenditures to meet the needs of the future.

Outgoing NEMA President A. A. Berard, Ward Leonard Electric Co, announced the establishment of a joint sections committee to coordinate several different product subdivisions in guiding those interested in automation. NEMA, he said, can be of particular assistance in standardizing complete products, components, or methods of control and production.

Another new NEMA activity will delve into state and local tax problems, request rulings from state authorities, and channel this information to member companies.

Gray Wins McGraw Award

Alvin N. Gray, Western Electric Co, received the coveted Manufacturers Medal of the James H. McGraw Award for Electrical Men at a general membership luncheon. The medal is given infrequently, and only to those whose contributions to the electrical industry are considered outstanding by a panel of judges.

Gray received his award for development of a process for extruding insulating wire rubber at room temperature. Over 30 companies now use the process, which eliminates many operating problems and considerable waste.

Two Veeps Re-elected

J. L. Singleton, Allis-Chalmers Mfg Co; and N. J. MacDonald, The Thomas & Betts Co, were re-elected vice presidents.

Six new members were elected and eight incumbent members reelected to the NEMA Board of Governors.

50-Year Men Honored

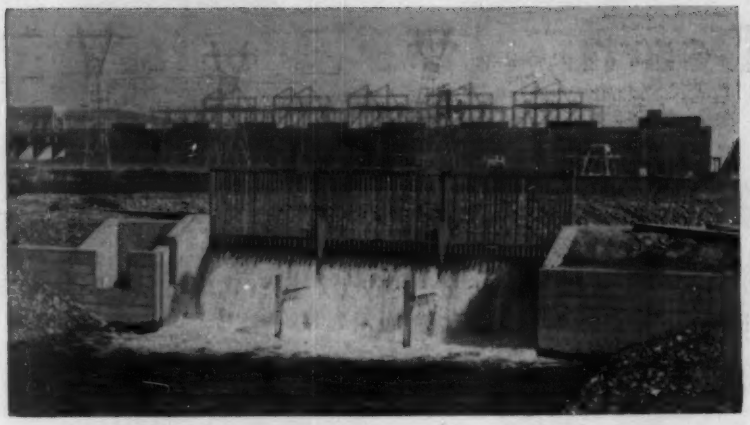
Edward F. Sixtus
Vice-president, Federal Pacific Electric Co. Has worked on product standards and development, and on switchgear.

Victor R. Despard
Vice-president at Pass and Seymour, Inc. Despard holds over 70 U. S. Letters Patents and several foreign patents.

Daniel J. O'Conor
Chairman of the Board (Emeritus), Formica Corp. A graduate engineer, he helped develop plastic insulating materials.

The new members are: Thomas McDonald, Minneapolis-Honeywell Regulator Co; H. N. Felton, Wagner Electric Corp; H. F. Lehman, Frigidaire Div, General Motors Corp; J. M. Otter, Philco Corp; E. R. Perry, National Vulcanized Fibre Co; and James F. Whitehead, Jr., Day-Brite Lighting, Inc.

Re-elected board members are: H. G. Blakeslee, Cory Corp; R. Stafford Edwards, Edwards Co; N. J. MacDonald, Thomas & Betts Co; A. F. Metz, The Okonite Co; W. R. Persons, The Emerson Electric Mfg Co; A. E. Pringle II, The Pringle Electrical Mfg Co; W. C. Robinson, Jr., National Electric Products Corp; and Clifford W. Smith, Telephone Sales Div, Western Electric Co.



'Fish Bowl' Idea May Revamp Dam Design

An artificial spawning channel on the downstream side of McNary Dam has proved successful in the first of two important tests. Under "gold fish bowl" conditions several hundred chinook salmon have paired off and spawned in the simulated upstream channel. If the young fry hatch next spring, dam designers may well have a solution to today's problem of costly fish passage facilities.

The project includes the spawning channel and holding pool with reinforced concrete control weir structures within the channel. Shown here is a small dam separating one experimental station. The upper station simulates above-dam conditions. In the foreground another section recreates tributaries of the upper Snake River. The channel has three independent stretches of water separated by screening devices. The first, a 100-ft pool, has a sandy bottom like that behind McNary's pool. On the downstream side, the second section's gravel bottom is comparable to running streams found upstream along the Snake. The third has run-of-the-river gravel like that in the upper Columbia and lower Snake. Channel width is 20 ft and over-all length about 900 yd.

The project was built by Corps of Engineers. Washington State Dept of Fisheries is conducting research.

Gas Company to Enter Power Field

Arkansas Louisiana Gas Co will build electric generating plants if necessary to retain its hold on the heating business. This is the view of the company's chairman of the board, W. R. Stephens.

He told Electrical World "If they (Arkansas Power & Light Co) get into the heating business, then we'll get into generation business."

Stephens referred to the recent decision to heat and cool the Little Rock Air Force base housing project with heat pumps (EW, Aug. 26, p 44). He said the all-electric decision might "be another Dixon-Yates. I have confidence the government will not subject taxpayers to that kind of loss."

The gas company's interest in the electric field began with a 7.5-Mw power plant now under construction that will serve a company-owned cement plant.

Stephens sees the power plant development as a "common" generation of electricity which would be wholesaled to municipals, co-ops, or power companies. Stephens has not sought approval from the gas company's board as yet. If and when he does, he will recommend that "we go the limit" on power plant construction.

Electric Heating . . . .

. . . makes its first big inroad into New England area when Western Mass' special rate goes into effect Dec. 1

Electric heating has come to New England.

In an unprecedented move, Western Massachusetts Electric Co applied for and received last week a special rate for the promotion of electric heating and all-electric living. Effective Dec. 1, the rate is offered to any customer who installs a permanent electric space heating system where no other energy source for comfort is used. Rate details:

- First 400 kwhr will be billed at present residential rates. Average: first 12 kwhr for $1.00; next 88 at 3.5¢; and all over 100 at 2.8¢.
- All over 400 kwhr will be billed at 2¢, except for energy used during a special 7½-hr nighttime period during which 1.3¢ will be the rate.
- Dual-rate meters will be used for electric heat customers; one dial records usage during 7½-hr off-peak period.
- Company officials estimate cost under the combination of rates will vary between 1.6¢ and 1.9¢ per kwhr.

Gas house heating rates in the area start at about 13.9¢ a therm, according to American Gas Association. No 2 fuel oil retail costs average 15.3¢ per gal., says National Petroleum News, a McGraw-Hill magazine.

Midwest Study Was Clincher

Western Mass has been considering the electric heat move for several years. The company sent teams into Midwest areas having comparable climate to its service area. Results of these team findings convinced them it was practicable. A rate was formulated, filed and approved.

One big facet of the Western Mass story: it's a strike in a new direction in an area known for its adherence to tradition. Commented WM's Public Relations Director George Keegan, "We pride ourselves on being a progressive outfit. We think this may be the first such rate of its kind in New England."

Instruments Caused British Reactor Incident

Insufficient temperature instrumentation in graphite core led to Windscale plutonium plant's radioactive outpouring

McGraw-Hill World News—The astounding sequence of independent events which first triggered and then aggravated the fire in Britain's Windscale reactor Oct. 10, was told in an Atomic Energy Authority report published recently.

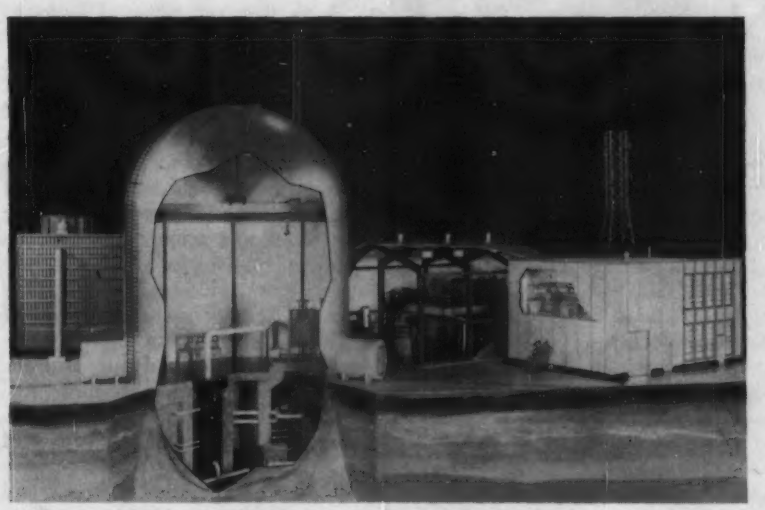
Insufficient temperature instrumentation in the graphite core was the main cause, the report says. This led to a completely wrong interpretation by the pile physicists of the temperature in the core, which was being heated during a routine annealing operation on the graphite.

Although the report emphasizes that no experiments were being carried out in the pile, it discloses a number of cans containing a lithium magnesium alloy were being irradiated. Concerning the possible failure of the alloy cans the report says, "It was a second possibility which cannot be entirely eliminated."

Many experts concede the AEA is irradiating lithium to produce tritium, the super-heavy isotope of hydrogen. It is believed this operation has been going on for some time to produce tritium for H-bombs and also for controlled hydrogen fusion tests at Harwell.

The bombardment of lithium with neutrons in a reactor to produce tritium is a fully recognized production technique and is therefore quite correctly not termed an experimental operation.

The report emphasizes a number of reasons why the incident could not occur at any of Britain's other nuclear reactors.



Vallecitos Atom Plant Dedicated

Officials of General Electric Co and Pacific Gas & Electric Co dedicate the Vallecitos developmental boiling water reactor plant today. The Pleasanton, Calif., facility officially went on the line Oct. 24 with an electrical load of 5 Mw.

The world's first privately financed atomic electric power plant, Vallecitos is a joint project of the two companies. Shown here in a cutaway model are the cooling tower, left; the reactor housed in its dome-shaped containment vessel; PG&E's turbine-generator building; and the control room and offices, far right.

NUCLEAR NOTES

AEC conferences, aimed at examination of nuclear power program's present and future, will be held in Washington, D. C., Dec. 3, 4, 5. Opening session for utilities will explore AEC's long-range plans, role of small power plants, cost aspects, and component bottlenecks.

Nuclear power losses at Shippingport may cost the government $24 million a year, says Southern Coal Producers' Assn Pres J. E. Moody. He claims the reactor on Duquesne Light's system will produce power costing "at least 65 mills per kwhr as compared to about 5 mills . . . for coal."

A directory of AEC organization, operations, and activities is now available. "Atomic Energy Facts" tells how to use AEC services and gain access to classified information. Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. Price: $2.

Thorium will be examined as a nuclear fuel for high temperature, gas-cooled reactors. Contract has been awarded to General Electric Co for a zero energy assembly for the British Atomic Energy Authority experimental project, which will probably be at Winfrith Heath. Thorium and uranium 233 will be incorporated in ceramics.

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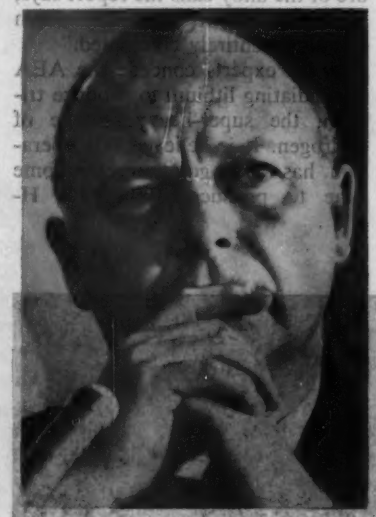

SEATON: Limited usefulness

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However, Otto Eckstein, Harvard University economist, suggests that legal and administrative changes be made to assure that partnership projects develop our rivers as efficient integrated systems. Further, Eckstein contends that in at least half of the projects being built, "It is unlikely that their effect on national income will be positive, even though they represent additions to the nation's capital stock."

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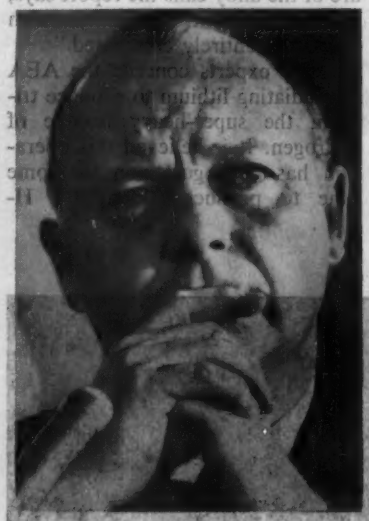

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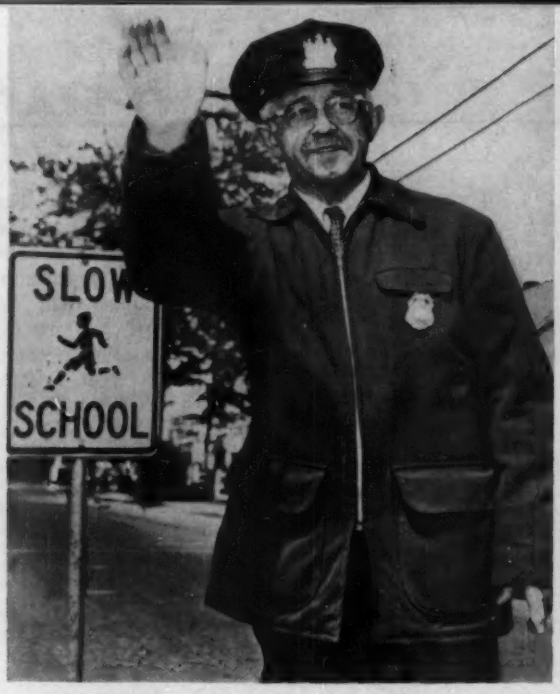


THIS MAN GROWS MUMS—1,200 plants of 110 varieties; he's in demand as speaker. He also serves children as guard

THIS MAN INVENTS THINGS—an umbrella-like clothes dryer in this case. This is only one of his ideas in 10 years

How Con Ed Helps Its Employees

Talks with top management, financial information, tips for better living—these are the ingredients of Con Ed's effective yet inexpensive pre-retirement counseling program

Age sixty-five—end of the road, or time for a fresh start in life? That question faces an ever-increasing number of utility employees as they approach the age of retirement. Sharing their concern, many utilities are exploring ways to help make the answer a happy one. Consolidated Edison Co of New York is one of them.

What happens to people after they retire? The problem had concerned Con Ed people for some time before they set up their pre-retirement counseling program four years ago. Retirement is, after all, a major change in the lifetime pattern. Income is usually slashed, lifelong habits and routines disrupted. Health problems often crop up at a time when medical expenses can be least afforded.

So it's no wonder that in a survey of 200 retired Con Ed workers, 19% admitted they were unhappy; of those with clerical backgrounds, the proportion was 43%.

As Con Ed figured it, many retirement problems could be resolved if only workers would think ahead. A Cornell University study reveals that pre-retirement planning is a highly significant factor in determining pre-retirement attitudes, and that these attitudes have an important influence on post-retirement satisfaction.

Many workers do prepare for their retirement. But others apparently assume "It won't happen to me."

Meddle or Muddle?

Con Ed wanted to help, but how? The problem, as Con Ed saw it, was that an attempt to encourage employees to think ahead might be misinterpreted as paternalism and thus do more damage than good.

Con Ed took the risk.

Personnel got together with departmental supervisors and worked out a plan for pre-retirement interviews. They gave it a six-month trial in the production department. Six months later most everyone was sold, and since November, 1953, the program has been standard practice throughout the company.

Food for Thinking Ahead

At least two years before an employee is scheduled for retirement, the personnel department prepares an information packet containing:

- His estimated gross monthly retirement annuity; estimated Social Security benefit; estimated net monthly retirement annuity from the company.
- His survivorship options.
- His wife's Social Security benefit when she reaches 62.
- Complete information on group insurance and medical coverage.

The interviewer, usually a bureau or department head, explains the facts and figures to the employee, and encourages him to think about

THIS MAN LOOKS AHEAD to the day when he won't be working in the production department. Planning an interesting future makes retirement palatable

Find a Happy Retirement

his future. This chance for the employee to speak to top management is one of the more important features of Con Ed's program. In fact, 252 out of 260 retired workers later interviewed said it was *most* important. Not only does the interviewer's position add weight to his words, but a worker who has never said more than "good morning" to his boss gets the feeling that the boss is, after all, interested in him.

No Advice Peddling

Explaining the philosophy behind Con Ed's program, Personnel Director Dwight Sargent says: "Our only purpose in these pre-retirement interviews is to give people the factual information they will need to complete their plans, and to encourage those who haven't already made their plans to get started."

For this reason, interviewers carefully refrain from giving any specific advice. They suggest lines of thought: "Will I want to do some kind of part-time or full-time work after I retire? (If so, Con Ed can usually get them a job.) Should I continue to live in the same place? Do I want to learn any new work skills or hobbies before I retire? How's my health, and my wife's?"

The employee can drop in again anytime to talk over specific problems or just spell out his ideas. And he can go up to personnel for special help, if he needs it.

About a year before retirement, the supervisor hands the employee six pamphlets over a ten-week period. Entitled "Notes for After Fifty," they're published by the National Assn for Mental Health, and stress common sense in making retirement plans.

After four years, Con Ed can say its attempts to help employees help themselves have been largely successful. While the participating supervisors feel that only two out of seven workers benefit, the workers themselves are more enthusiastic. Con Ed asked 260 of them what they thought of the program at the time of their retirement. Of this group, 131 had made no plans prior to the pre-retirement interview. Seventy-nine said the interview helped improve their plans, and 69 said it actually started them planning. The financial information proved of real value to 234 workers, and the booklets received similar approval.

Virtually all of the retired employees said the interviews were worthwhile. One man commented, "I sort of shied away from the whole subject—had an idea that retiring meant going on the shelf. What I needed was a little needling, and that's what I got in the interview. When the time came I was ready for retirement and now I'm enjoying it."

One couple was especially enthusiastic about their supervisor's suggestions. They had planned to move in with relatives after retiring. On the supervisor's suggestion, they tried living with them on a vacation. After a few days of clashing personalities and jangled nerves, they revised their retirement plan.

Apathy the Big Problem

Women workers, the interviewers found, are vague about retirement plans, preferring to "think about it when it comes." But apathy remains the chief problem for both sexes as they face a crucial turning point in their lives.

Post-retirement work plans are a good example. Despite the fact that 93 of the 260 interviewed said they would look for a job, only nine had lined up one before retiring, and only 11 had made an effort to find one afterwards. Many preferred to sit back for six months and collect unemployment insurance, even though most of them would probably be better off physically, mentally, and financially if they went to work.

Another stumbling block to retirement plans is the factor of uncertainty, the increasing possibility of death or illness which can overwhelm the best of plans. At the age of 55, only three out of five people will live ten years or longer.

These are some of the reasons why Con Ed doesn't plan a more elaborate retirement counseling program.

"We could do ten times as much," Sargent says, "and possibly get 5% better results. As our pre-retirement counseling program operates today, it is neither elaborate nor expensive, but we believe that it does meet the needs of our employees."

'Early Bird' Loading Computer

Pennsylvania Electric Association systems group meets at Bedford; relay and meter men at Reading and Sharon

The "Early Bird" has double the estimated system savings of the Southern Co in three years of operation, Grady L. Smith, Southern Services, Inc, told the Pennsylvania Electric Association's Systems Operation Committee at its Oct. 24-25 meeting at Bedford, Pa. Savings through use of the economic loading computer, Smith said, were originally estimated at $200,000 annually.

The Southern system's next step, he said, will be conversion to automatic steam regulation throughout, the computer being used to route signals to units under control.

During 1955, first full year of operation, transmission losses were less than those of 1953, although power delivered to substations had increased 16%, Smith said. Losses dropped from 8.33% in 1953 to 7.15% in 1955 and to 7% in 1956, with generation requirements reduced by 250 million kwhr a year. Dollar savings associated with these decreased losses, he said, exceeded $600,000 annually at an assumed unit cost of 2.5 mills.

GRADY SMITH outlines performance and future of Early Bird computer

Describes Control Curves

Operation, Smith said, has shown that the reduced transmission losses could be realized without the expected boost in unit production expenses. He attributed this to the improved accuracy in determining incremental production costs and in improved incremental loading of units with the Early Bird. Units formerly loaded in blocks of 5, 10, or 20 Mw, now are loaded in 2, 3, or 5-Mw blocks. Further improvement is expected as automatic control will load units in 1-Mw or smaller blocks.

Initial installation of automatic control, planned for early 1958 at the latest, will cover 28 units at ten plants having a total capability of 2,315 Mw. The plan is to have 44 units in 15 plants with a total capability of 3,328 Mw under automatic control by 1959, Smith said. Savings should pay off the $300,000 investment in less than two years.

Information required by the Early Bird will include tie-line loadings, output of all plants, unit fuel costs at each plant, and large, non-conforming loads. From these data the computer will determine incremental generating cost, incremental transmission losses, and incremental cost of delivered power.

Under automatic control, the incremental cost of delivered power of all units will be scanned constantly, Smith said. The computer will control the sending of "raise" impulses to all units with incremental cost of delivered power below the system average and "lower" impulses to units with costs above the average. The automatic equipment will sense a cost difference of 0.02 mill, compared with the 0.1 mill cost difference under existing manual control. The Early Bird will control only the routing of raise or lower impulses. Tie-line flow with frequency bias will remain the basic control parameter.

E. L. Mueller said control curves for Kansas City Power & Light Co's combination load-frequency control and economic loading equipment are based on heat-rate curves revised to give continuous coverage between 8,200 and 22,000 Btu per kwhr. Control curves for older stations assign load on a station basis to eliminate "boiler-swing" problems, he added.

The economic dispatch computer, plus load-control equipment, is a considerable improvement over manual control of rapid load changes during morning pickup and evening peak and dropoff, said J. L. Winans, Ohio Edison Co. After maintenance personnel were put on 24-hr call, he said, outage time on the computer dropped from 19.6 to 1.5% for an average of 7.6%. In the first nine months of 1957, overall availability has been 92.5%, an additional 4.8% being for other uses.

An economic dispatch computer has decreased block loadings from 30 or 40 Mw to 5, 10, and 15 Mw, said A. P. Farley, West Penn Power Co. Improvements since its installation include a dial which indicates total system generation. The manufacturer, he said, is working on an addition which will compute and read out the average cost of power blocks to be bought or sold on an economy basis with other systems. One advantage will be automatic determination of how much power can be bought at a given price without exceeding any desired system incremental cost, said Farley.

Gives New Concept

A new philosophy of primary and local back-up protection for a 650-Mw station and associated transmission was determined by system stability requirements. This new concept and a symposium on pressure-type relay protection for transformers highlighted a recent meeting of the Relay Committee of the Pennsylvania Electric Association at Reading, Pa.

The new philosophy of back-up protection at Eddystone Station will protect against the possibility of losing a major portion of the system, reported W. H. Brands, Philadelphia Electric Co. Eddystone Station will consist of two 325-Mw cross-compound turbogenerators feeding into a 132-kv bus. Transmission associated with the station requires about 100 miles of new line, including ten 132-kv lines, two 66-kv, and one 220-kv.

The problem essentially is one of

Doubles Estimated Yearly Saving

clearing phase faults on backup in the shortest time possible to avoid instability through loss of the station. The local backup protection scheme uses entirely separate primary and backup relays operating from separate instrument transformers. Only failure of a station battery can cause failure to clear a fault. The scheme is designed to trip the minimum number of breakers to clear a fault consistent with reliable selectivity, said Brands.

One in Seven Correct

Use of sudden-pressure relays for transformer protection among 19 utilities in the northeastern quarter of the country was summarized by H. P. Haddy, Philadelphia Electric Co. Of 13 companies using 459 relays, five connect for trip only, four either to trip or alarm only, two either for trip and alarm or alarm only, and one each for trip and alarm only and alarm only.

Most transformers 7,500 kva and above, and many in the 2,500-7,500-kva range for American and Foreign Power Co have sudden pressure relays as well as differential protection, said Richard M. Nokes, Ebasco International Corp. It is better to risk a few unnecessary tripouts than have greater transformer damage, he said, adding that he is not convinced that sudden pressure relays always work correctly.

Of seven operations of pressure-type relays, one was correct, two were incorrect operations associated with faults external to the transformer, and four were caused by personnel failure, reported W. A. Kling and D. H. Jackson, Central Hudson Gas & Electric Corp. The most disconcerting factor in incorrect operation is the questionability of re-energizing the transformer bank.

Sudden pressure relays provide sensitive protection for light internal faults and can supplement a simple differential relaying scheme set insensitive to inrush currents, said J. L. Blackburn and E. C. Wentz, Westinghouse Electric Corp.

A major consideration in evaluating use of sudden pressure relays is the ability to test, maintain, and retest the units with consistent and significant results, said J. L. Harmon and P. B. Perry, Cleveland Electric Illuminating Co.

Discusses Sampling

Sample testing provides data for a fairly accurate appraisal of meter performance by type, age, or class, reported by R. V. Keleh and W. E. Whitmer, Ohio Power Co, to the Meter Committee of the Pennsylvania Electric Association recently at Sharon, Pa. Based on sample testing of meters in three districts, subdivided by urban and rural groups, this approach may not necessarily reduce testing, but more importantly, will show where emphasis on testing should be placed.

Northwest Public Power Association hears

Home Economist Has Vital Appliance Role

Many electric appliances are bought and shelved because the homemaker has not been instructed in their use, the Northwest Public Power Association was told at its annual power use workshop Oct. 3-4 at Newport, Ore.

Beth Bailey McLean, Oregon State College, declared that only woman to woman talk could prevent a buyer wooed by today's sales talk from becoming the "bearcat" who tells the world tomorrow that she is dissatisfied.

"Hence," she said, "there is a real place for the home economist in any business that sells goods or services to women."

Pointing to a 33% business growth projected for the Northwest, she asked bluntly, "Who's going to get it, natural gas or you?"

A survey of large cooking establishments in its service area provided Seattle City Light with a prospect list and revealed wiring inadequacies and service difficulties to be overcome in the installation of electric commercial cooking, said John G. Benson.

City added 4,416 kw of commercial cooking load during 1946, which averages out at 3.2 kw per customer, he continued. This load increase is expected to boost revenue some $66,240.

Don Johnson Named

After 11 months of natural gas competition, Seattle City Light is still installing more and more commercial electric water heating equipment, said William A. Hupprich. But gas, he added, has won considerable acceptance in some new housing districts.

Aiding City in competition, he said, was development of a new tank design for motels and hotels or any other use requiring large consumption accompanied by quick recovery.

Pointing to correspondence and research leading to elimination by the building code committee of the fire-wall requirement for electric tanks, Hupprich said, "Watch your building codes. Don't let them fence you in. A fire-wall separation is necessary for flame-type equipment only."

Carefully timed promotions of appliances of proved practical value will be the second phase of the Farm Better Electrically program, Fred E. McVey, REA, said. Initially, the program will bring farmers information on practical applications useful in the farming business, he said.

At the concluding business meeting, Don Johnson was named chairman, and Charles Nash, British Columbia Power Commission, vice chairman of the section. The 1958 workshop will be held at Victoria, B. C.

DISTRIBUTION TROUBLES were the subject of panel, left to right: B. M. Gallaher, Texas Electric Service Co; M. L. Watts, Humble Oil & Refining Co; R. M. Howe, Magnolia Refining Co; and, L. D. Cronin of Ebasco Services, Inc.

EE Schooling Deficiencies Cited

Univ. of Texas distribution conference hears Rittenhouse indict high school preparation and training of teachers

Engineering education today is handicapped by deficiencies in the students' high-school preparation and by its failure to attract teachers who can teach, the Tenth Annual Power Distribution Conference was told Oct. 28 at Austin, Texas. The conference, sponsored by the University of Texas, Department of Electrical Engineering, was attended by 350 engineers from utility and industrial firms throughout the Southwest and from more distant states.

Engineering education suffers today from the lack of preparation in mathematics and the sciences in the progressive education system in vogue in the high schools, said J. W. Rittenhouse, Hi-Voltage Equipment Co.

Two other factors that aggravate the educational problem, he said, are the stress on research and publication to the neglect of preparing teachers who can teach, and the collegiate emphasis on research and the highly theoretical approach. This latter factor, he added, tends to the neglect of practical applications of engineering principles and the failure of teachers to teach students what to do with the theory they have learned.

Dr. Logan Wilson, University of Texas president, declared that the lack of teachers and facilities should not be supplied by federalizing education. The federal government, he argued, has no money that is not available within the states.

Distribution system outages have been reduced by adding wood to structures and using 60-deg shielding cones on open wire, the conference was told. More wood in distribution system structures increased the flashover level and reduced 60-cps follow current, declared B. M. Gallaher, Texas Electric Service Co. R. M. Howe, Magnolia Petroleum Co, said that a 60-deg shielding cone on open-wire distribution circuits virtually eliminated circuit outages due to lightning. Aerial cable, he added, helped solve problems of insulator flashover due to contamination and of pole congestion.

Eliminates Corrosion

Hardware corrosion problems on the Humble Oil & Refining Co system at Baytown were ended by the use of stainless steel and bronze, said M. L. Watts. Compression connections, he added, eliminated connector corrosion problems.

Ferro resonance may explain some overvoltage problems, Dr. E. W. Boehne, Massachusetts Institute of Technology, suggested during a demonstration in which he tuned test equipment to ferro resonance and showed oscilloscopes.

High-speed breakers and the careful application of reactors can control the duration and magnitude of short circuits, said G. G. Auer, General Electric Co.

Each large power transformer must be considered separately in order to realize the maximum use of equipment, said C. O. Love, Texas Power & Light Co. When a user knows all the factors of the transformer's performance and the local conditions of load and ambient temperature he can use up to 30% additional capacity.

Computers facilitate the solution of repetitive problems in determining the most economical means of meeting a distribution system requirement, said J. K. Dillard, Westinghouse Electric Corp. Rapid expansion of distribution systems, he added, is encouraging their use.

Most electrical equipment will be insulated with silicones in the next 5 to 10 years, said John Dexter, Dow Corning Corp. M. L. Manning, Pennsylvania Transformer Co, noted that silicone rubber is the most promising of the insulating materials now available.

N. D. Kenney, Simplex Wire & Cable Co, noted the ability of silicone insulation to withstand high temperatures without deterioration. The conductor metal in silicone insulation, rather than the insulation itself, may determine the top operating temperature limit, he said.

The City Public Service Board, San Antonio, has a system for evaluating transformers of the various manufacturers, said J. B. Poston. It is based on the losses of various makes, and other characteristics.

In establishing the system, the board purchased a group of 10 to 20 transformers in 15-kva class, tested and disassembled them for inspection. Various features, he said, were evaluated and the gradings established were turned over to the purchasing department.

Southeastern Electric Exchange hears McQuiston . . .

Urge Dedication to Electric Living

Electric company employees must rededicate themselves to selling complete electric living, the Southeastern Electric Exchange was told at its Oct. 16-18 sales meeting at Birmingham, Ala.

"It would not be unjust to make electrical living a prerequisite of employment," declared T. O. McQuiston, Metropolitan Edison Co. To encourage electrical living, the utilities should simplify their rate schedules and requirements, he said, urging the utilities to revise unrealistic restrictions on water heaters. The latter, he said, have caused the loss of trade allies, national advertising, sales effort, and objectives.

Urges Area Development

Those areas attract industries which prepare for their coming through planned development, said R. N. Fricke, Virginia Electric & Power Co. Such preparation, he said, is most important on the community level.

Light generated by exciting phosphors with alternating current could soon be in a practical stage, said Carl Jensen, Westinghouse Electric Corp. This new light source, called electroluminescense, gives greater brightness as frequencies and voltages increase. Its attractiveness lies in the fact that it provides a large-area source of glare-free light.

Cleveland Electric Illuminating Co uses mass-promotion techniques to reach industrial customers, R. W. Wyman said. Mailings and meetings, he said, present lighting, heating, and general modernization ideas to all levels of plant personnel.

Utilities should seek the cooperation of industries in planning for the terrific demand that will be placed upon them by automated plants, said W. C. Allen, Westinghouse. Such cooperation would assure reliable supply, he said.

A prospect becomes a customer when he is given the economic facts on motor-driven as compared with absorption refrigeration, said P. A. McLeod Jr, Worthington Corp. A customer, he said, should also be told about such motor-driven refrigeration intangibles as flexibility, simplicity, and reliability.

Poultry-house cooling increased summer egg production, said Price Hobgood, Texas A&M College. Egg size and fertility also benefited.

Farm electrification has increased as a result of the promotional use of the Farm Better Electrically slogan and symbol, said H. H. Beaty, Edison Electric Institute. Farm ventilation literature, he said, has been developed, and work is progressing on promotions for water heating, crop drying, yard lighting, and brooding.

Sell electric heating and the all-electric home is sold too, said S. H. Booker, speaking for Roland Oliver, Alabama Power Co. One installation sold sells two or three others, he said, adding that cooperation between utility salesman and contractor assures the customer of fair treatment.

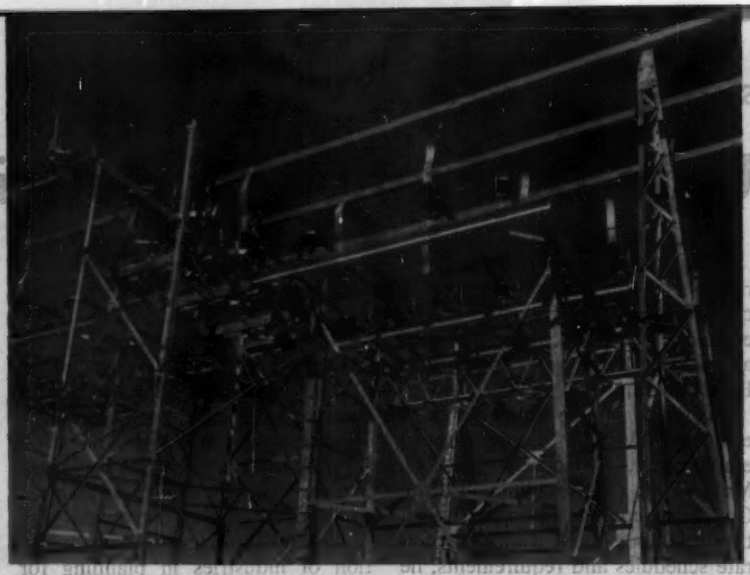
High-frequency lighting gives an experimental plant chamber an illumination of 1,400 to 2,300 ft-c, said R. B. Rogers and C. J. Turner, of Clemson Agricultural College and South Carolina Agricultural Experiment Station, respectively.

The system, they said, uses standard warm white slimline lamps supplied from a static frequency multiplier which converts 60-cps 3-phase power to 360-cps square-wave supply with an increase in voltage.

By guaranteeing satisfaction, New Orleans Public Service, Inc., sold 1,383 dryers in two months, said A. B. Lindauer, adding that there was not a single request for refund.

SPEAKERS at SEE—Sales general session, Birmingham, Ala., left to right, are: C. M. Wallace, Georgia Power Co; T. O. McQuiston, Metropolitan Edison Co; R. N. Fricke, Virginia Electric & Power Co; Carl Jensen, Westinghouse Electric

- Determine conductor grade, shape and size for the load
- Support the bus to take full advantage of electrical and mechanical properties
- Select the proper method for joining and connecting



BOLTED CHANNEL BUS for a 13.8-kv substation of Nantahala Power & Light Co is supported by suspension insulators. Aluminum 5-in. channels are used

Three Steps Lead to Economical

DONALD H. SANDELL, Staff Electrical Engineer, Electrical Conductor Division, Aluminum Co of America, Pittsburgh, Pa.

Aluminum conductors provide reliable and economic bus installations, when the effort of the designer is coupled with that of forces erecting and joining it. For the optimum in aluminum bus installations, three steps are important: The conductor grade, shape, and size must meet load requirements; the bus should be supported to take full advantage of electrical and mechanical properties of the conductor; and, the proper method of joining and connecting must be used.

The designer first confronts a myriad of grades, shapes, and sizes, from which the most desirable aluminum conductor must be chosen. Selecting the proper one can be done best by comparing the physical and electrical properties of aluminum and its alloys. Aluminum conductor (EC) is used in stranded cable, ACSR, most rolled shapes, and many rectangular bars. It has a volume conductivity of 61% IACS (International Annealed Copper Standard) but a 200% conductivity rating on a weight basis.

Most tubular bus and structural shapes are heat-treatable alloys combining high strength, good conductivity and weatherability. The alloy most used for tubular bus in substation construction, 6063-T6, has a typical 53% conductivity and a minimum 30,000-psi tensile strength. No. 2 EC alloy has a 55% minimum conductivity in the T6 temper and 57% in the T61 temper. Mechanical properties of No. 2 EC are only slightly lower in equivalent tempers than those of alloy 6063. Higher conductivities have been produced in experimental grades. Physical properties are in the accompanying table.

Choosing Conductor

Choice of conductor, alloy, and shape is determined largely by the installation and electrical load. Besides installed cost, these are factors considered:

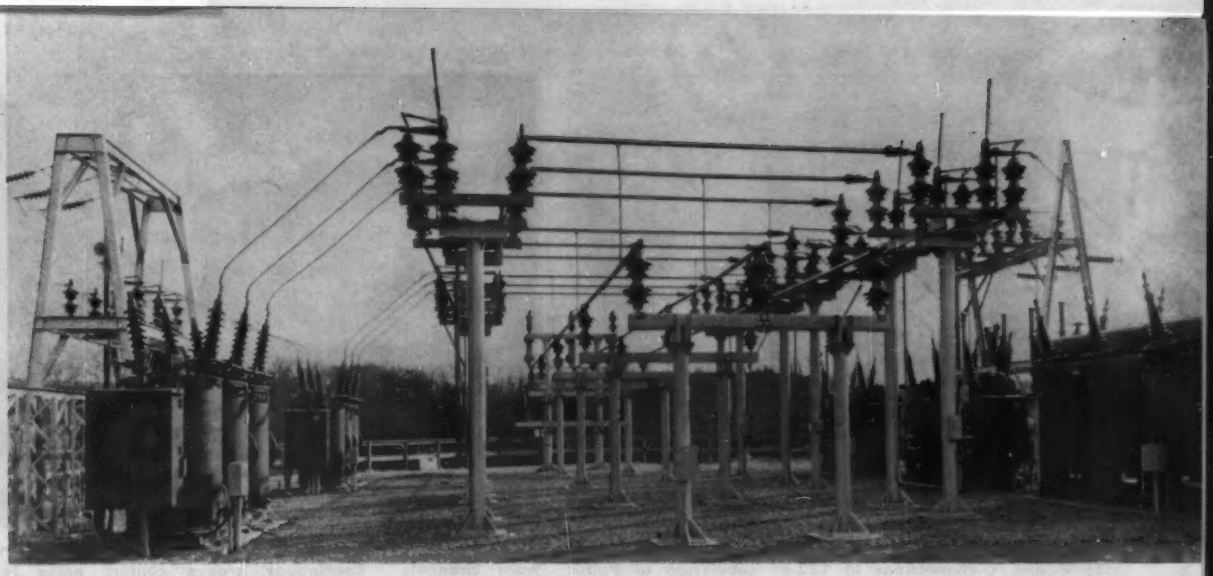
1. Voltage drop and power loss. These are functions of the effective resistance of a conductor for a given current. A type or shape having the lowest resistance should be selected. Tubular bus is the most efficient carrier of ac because of its low ac/dc resistance ratio.

2. Current-carrying capacity and short-circuit loads. Ability to carry current is determined by the balance between I^2R heat losses in the conductor and heat dissipated by the conductor at a given temperature gradient in air. This gradient usually is a 30C rise over a 40C ambient temperature (70C operating temperature). EC aluminum conductors can operate up to about 93C without appreciable reduction in strength due to heating. No. 2 EC-T6 and 6063-T6 operate up to about 121C.

Heat dissipated by the conductor at a given temperature gradient is proportional to surface area, surface radiation characteristics (emissivity factor), and wind velocity crosswise to the conductor. Because of greater surface area, rectangular bar and some structural shapes carry more current for a given temperature rise than the more efficient tubular bus. Reliable values of emissivity are available (Effect of Emissivity on Current-Carrying Capacity of Stranded Aluminum, C. S. Taylor and H. E. House, "Power Apparatus and Systems," 1956). The one uncertain variable in heat dissipation is air velocity. A reasonable estimate is 2-fps (1.36-mph) wind usually assumed for temperature-rise calculations.

When considering mechanical resistance to short-circuit forces, fiber stress is important. It can be determined from formula (1) in the panel.

[D] Adapted from a paper presented at the Southeastern Electric Exchange Engineering & Operation Conference.



TUBULAR BUS with welded fittings is used in a 66-kv substation on the system of Philadelphia Electric Co. The 3-in. SPS aluminum tubular bus is supported by 10-in. IPS steel pipe which is filled with concrete for rigidity

and Reliable Aluminum Buses

For a typical relation between a 2½-in. SPS copper bus and an equivalent 3-in. SPS aluminum bus, assuming equal forces per unit length, the fiber stress formula reduces to (2) for aluminum and (3) for copper.

3. Ice and wind loads and aeolian vibration. Aluminum bus shows up favorably when resistance to mechanical loads is considered. The familiar deflection formula for a simple beam may be reduced to formula (4). Thus, the deflection for a 3-in. SPS aluminum tubular conductor is in formula (5) and for an equivalent ampere-capacity 2½-in. SPS copper conductor in formula (6).

Aeolian vibration always is possible on outdoor bus. This tendency is dependent on conductor size and shape and on steady-state wind velocity crosswise to it. It is independent of conductor material. Vibration usually is of no great concern, stresses induced being generally small. A 3-in. SPS aluminum conductor exposed to steady-state crosswise winds may produce amplitudes of 2 to 3 in. in a 25-ft span. This stresses the conductor to about 4,000 psi. A 6063-T6 aluminum

Physical and Mechanical Properties of Bus Conductors

	Specific Gravity	Coefficient of Linear Expansion per Deg C	Modulus of Elasticity	Electrical Conductivity % IACS 20 C Volume	Weight	Strength, psi Tensile	Yield
Aluminum							
EC-H12	2.70	0.000023	10×10^6	61	201	12,000	8,000
No. 2 EC-T6	2.70	0.000023	10×10^6	55	181	29,000	25,000
No. 2 EC-T61	2.70	0.000023	10×10^6	56	184	20,000	15,000
6063-T6	2.70	0.000023	10×10^6	53(1)	174	30,000	25,000
6061-T6	2.70	0.000023	10×10^6	40(1)	132	38,000	35,000
Copper							
Hard-drawn	8.89	0.0000166	16×10^6	98	98	40,000(2)	25,000
Iron							
Malleable	7.31	0.0000126	25×10^6	10–16	12–19	51,000	31,000

(1) Typical conductivity; (2) Nominal strength

Formulas For Bus Design

$$f = \frac{w L^2}{8S} \quad (1)$$

where
w = force per unit conductor length
L = span length
S = conductor section modulus

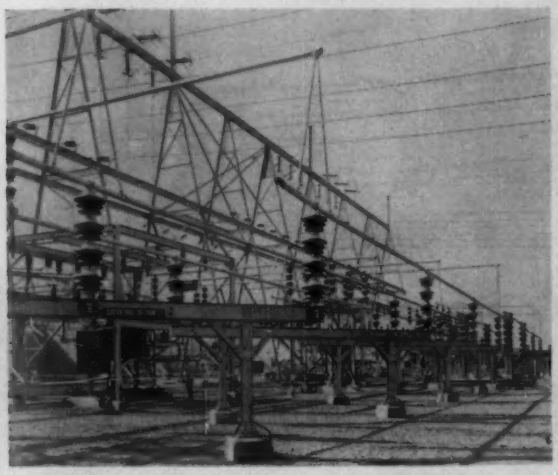
$$f_{al} = \frac{K}{1.72} \quad (2) \qquad f_{cu} = \frac{K}{1.06} \quad (3)$$

$$D = \frac{K}{EI} \quad (4)$$

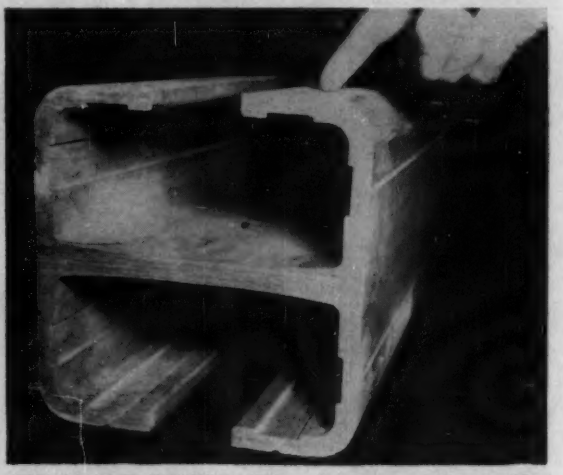
where
K = constant for given load and span
E = modulus of elasticity
I = moment of inertia

$$D_{al} = \frac{K10^{-7}}{3.02} \quad (5)$$

$$D_{cu} = \frac{K10^{-7}}{2.45} \quad (6)$$



WELDED A-FRAMES with cast fittings assure uniform angles for V and T connections in 132-kv substation of Public Service Electric & Gas. Aluminum tubular bus is 4 in. OD



INTEGRAL WEB CHANNEL BUS replaces box girders welded from channels. Continuous groove centers holes for field drilling. It may be joined by welded splice plates

tubular bus withstands repeated completely reversed stresses of over 9,500 psi for 500 million cycles.

To damp aeolian vibration, a cable inside the conductor or a Stockbridge damper clamp on the conductor is satisfactory if mechanical linear acceleration is greater than gravity (32 ft/sec^2). These measures usually are necessary only where the appearance of vibrating conductors is objectionable or the vibrating conductors may damage supporting structures.

Design features contributing to conductor vibration are conductor supports of very small contact surface, high pedestal-type insulator supports of flexible design, long conductors in cantilever, or very long open repeated spans. Economy of the pedestal type support, without its undesirable features, may be retained by designing and constructing supports from steel pipe filled in place with concrete. A concrete-filled pipe has definite advantages over an H-frame support in its high resistance to flexing.

4. Corrosion and corona and radio influence. Aluminum bus conductors are fabricated from corrosion-resistant alloys. Past performance in marine and industrial atmospheres attest their ability to remain trouble-free.

Usually corona and radio-influence noise must be considered only for high-voltage and above construction. These factors generally are at the lowest level on tubular bus; its large constant radius of curvature reduces voltage stresses, thereby minimizing objectionable noise.

The second step toward reliable, economic aluminum buses is design and construction of supports. Vertical or column-type structures are used where ground area is restricted and many levels of bus connections are desired. Tubular aluminum bus is ideal for this construction as it can be formed in any direction without first annealing. Field forming is easy with a conduit-type bender for bus conductors as large as 4-in. SPS. The resulting bus configuration is neat and holds its shape with few supports. Many coupler connections may be eliminated as lengths of 40 ft or greater can be field-formed for a complete run.

Open Construction Better

Open or horizontal construction affords the greater saving. Where space is sufficient horizontal-type substations are desirable for their lower cost and greater flexibility. Lightweight and high-section properties of aluminum tubular bus afford a substantial saving in structure costs, and light weight reduces erection costs. With long tubular aluminum many joints may be eliminated.

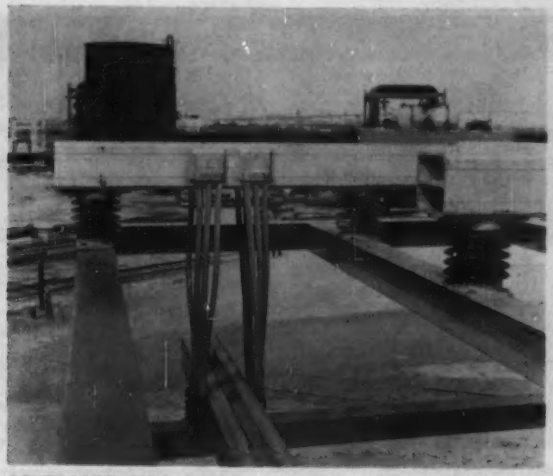
Tubular bus becomes part of the bus structure in horizontal construction. It allows circuits at different elevations with only one level of supporting structures. This is accomplished through A-frames or inverted-V connections typical of tubular bus in open construction.

For high-current applications, structural channels can be field-erected into a structural section similar to a box girder by using bolted or welded lacings as separators. Channels in a toe-to-toe position have high resistance to short-circuit forces as well as great current-carrying ability.

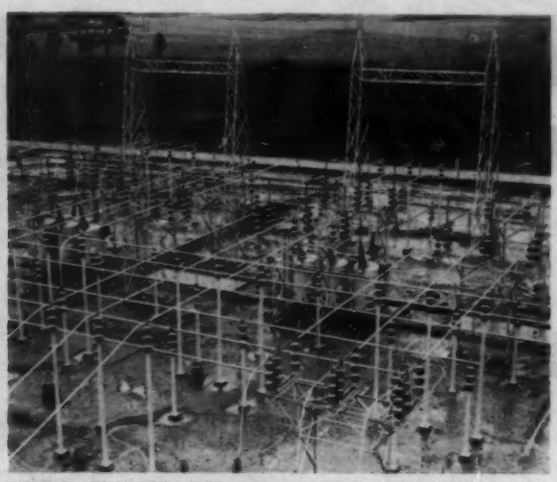
A new type of conductor called Integral Web Channel Bus (IWCB) eliminates field-fabricating of box girders from channels. Current-carrying capacity of IWCB approaches two boxed channels, and stiffness is considerably greater than two boxed channels joined by spacers or lacings. The web eliminates lacings or spacers. A continuous groove on the outside of the bus allows centering drilled holes for bolted taps or supports. A rectangular inside groove provides a recess for the bolt heads. Holes are punched or drilled along the center of the web for drainage and ventilation.

Principal use of IWCB is for generator leads and substation conductors, such use being made by Public Service Electric & Gas Co, Carolina Power & Light, Minnesota Power & Light, Southern California Edison, Public Service of Arizona and Tennessee Valley Authority. It is used for low-voltage underground distribution by Consolidated Edison Co and Long Island Lighting Co.

In several locations, cost of sup-



GENERATOR BUS of 11-in. IWCB is joined by 1,272-MCM rope-lay conductors at Linden Station of Public Service Electric & Gas. Supporting insulators have special caps



BOLTED TUBULAR BUS in 115-230-kv North Vancouver substation of Bonneville Power Administration consists of both 3 and 4-in. SPS tubular aluminum

porting structures has been reduced by supporting rigid bus on suspension insulators. Such support has been used for tubing, structural angles, structural channels, and integral-web channel bus. These installations, some 20 years old, have excellent operating records.

In this construction, the buses are free to swing and absorb peak energy from short-circuit forces. Accordingly, neither the bus nor the supports are designed to withstand short-circuit stresses as high as those on rigidly supported buses.

Third step covers methods of joining aluminum bus to apparatus. Saving in installed cost of aluminum bus conductor depend largely on the use of the basic principles of making good electrical connections in selecting fittings.

For many years aluminum bus has been joined effectively with bolted connectors made from corrosion-resistant aluminum alloys. High-strength aluminum bolts with an alumilite finish, protected by an anti-oxidant, should be used. The finish and the inhibitor provide resistance to corrosion and a near-constant ratio between tightening torque and clamping force.

Of equal importance is the manner in which the connector is installed. Contact surface must be cleaned and protected by an inhibitor. A joint compound developed by the author's company chemically dissolves metallic oxides without attacking aluminum or copper. It assists the mechanical abrasion of the conductor to remove the oxides. Tests show that contact resistances for varying contact pressures of lap joints on rectangular bar with the compound rival silver-plated joints.

Many bolted connections to copper apparatus must be made during construction. The same technique for joining aluminum bus works well for bolting the bus to apparatus. Either steel bolts with Belleville spring washers or high-strength aluminum bolts with flat washers work well for connecting aluminum bus to copper terminal pads. The Bellevile spring provides spring follow-up resulting from the difference in thermal expansion among aluminum, copper, and steel. Aluminum bolts with flat washers have these inherent spring follow-up characteristics.

Brazing or Welding Possible

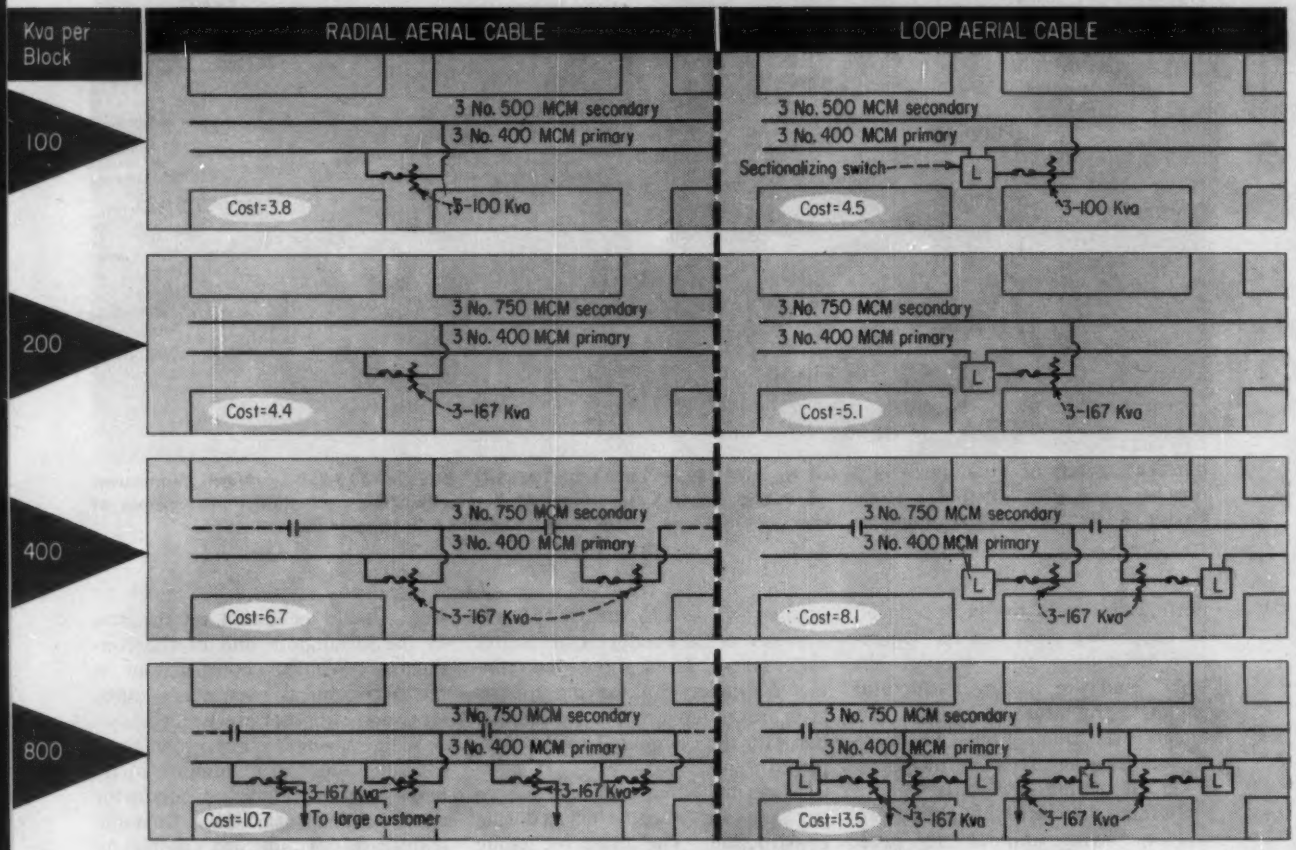
Aluminum bus may be joined also by brazing and welding. Brazing is limited to conductors 2 sq in. or less in cross section. The time required to make a brazed joint results in excess annealing on larger conductors. Brazing flux, being highly corrosive, must be removed from a joint before it is placed in service.

Welding of aluminum bus gains more favor throughout the industry every year. It affords many economies by eliminating many connectors and fasteners. The decision to weld should be based on the size of the installation and of the conductor. Welded construction is most economical when many joints, taps, and supports are needed.

Where strength is important, heat-treatable alloys of aluminum tubing have been selected for conductor when welding is used. Heat-treatable alloys are not annealed completely after welding, as are non-heat-treatable alloys. The magnesia-silicide alloy 6063-T6, used for tubular bus in outdoor stations, has a 30,000-psi minimum ultimate strength. After welding, its tensile strength is 19,000 to 20,000 psi. This is 38 to 40% higher than the fully annealed metal.

Two methods adapted to welding aluminum bus conductor employ an inert-gas-shielding envelope around an electric arc. No flux is needed. One, using a nonconsumable tungsten electrode, is called tungsten-arc welding. The filler rod is fed manually. The second uses a consumable non-coated aluminum electrode automatically fed through a welding gun. It is called consumable-electrode welding.

The method to use is determined largely by the type of welding to be performed. Tungsten-arc is particularly good for in-place welding. Although the consumable-electrode process works well for inplace welding, it is preferred for many welds taking considerable time. As it permits very fast welding speeds, the conductor experiences a minimum of annealing.



A recent study of these four systems produced significant results. They might make

Look to Aerial Cable and Vaults

Florida P&L study shows loop or throwover system, or combination of the two, is best for load densities up to 600 kva per block

R. H. **STEVENS**, Miami Area Engineering, Florida Power & Light Co, Miami, Fla.

A distribution system combining aerial cable with transformers in vaults offers strong possibilities for applications in medium-density business sections. According to a Florida Power & Light Co study, a loop or throwover system, or a combination of the two, would be desirable for densities up to 600 kva per block.

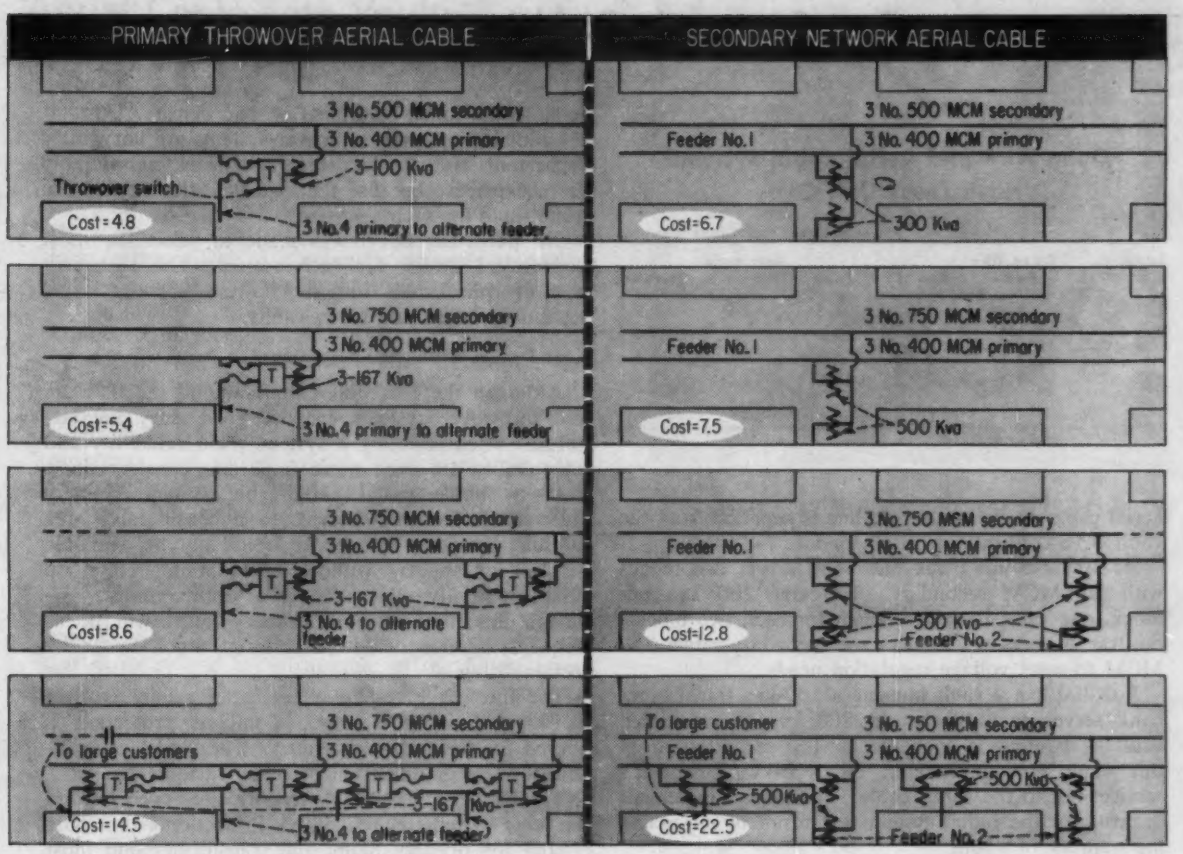
Adapted from a paper presented before Engineering & Operation Section, Southeastern Electric Exchange

These are the main conclusions of an examination of cost, reliability, and adaptability of four aerial-cable-and-vault systems: simple radial; loop; primary throwover; and, secondary network.

Company engineers made the study in an effort to develop better distribution methods for small business areas. Better service and improved appearances are needed for these expanding commercial areas, such as small-town business districts, arterial streets leading to larger downtown areas, and large apartment-house districts.

Load densities are too low to justify complete underground for serving these districts. Consequently, load requirements have been met partially by aerial cable or vault transformers fed from open-wire lines. A system combining aerial cable with vaults has received little attention.

Yet such a system offers many advantages: a high degree of protection from wind damage, conductor burndown, lightning, and other susceptibilities of open



distribution engineers . . .

for Serving Small Business Areas

wire; the neatness of aerial cable and absence of above-ground transformers; and, reduction in voltage drop, resulting from aerial cable secondaries. The last leads to the economies associated with the use of larger transformers.

For the analysis a unit block system was chosen, the representative block being 300 ft long on 60-ft streets. To cover adequately the practical limits of an aerial cable system, four levels of load density were studied—100, 200, 400, and 800 kva per block. These several basic assumptions were made:

- All transformer vaults are installed by the utility on public streets and alleys.
- Estimates are based on use of rubber-insulated cable.
- Costs of services and meters are omitted.
- Voltages are 13.2 kv for grounded wye primary and 120/208 v for secondary.
- Load is uniformly distributed for all levels, except 800 kva per block. At that level the load is divided into 400 kva at uniform density and 400 kva concentrated at the center of the block. This spotting of large loads in a medium-density area is probably close to reality.

Costs were estimated for each system at each load density to determine as accurately as possible all costs connected with providing alternate primary service. Not considered in the analysis were express feeders and substation problems. It is recognized that estimates may not be entirely accurate in actual application because distribution problems vary beyond the business area.

As a common denominator, the conventional overhead open-wire system at 100-kva-per-block density was assigned the value of unity. All other systems were rated on this per-unit basis (see table).

On the radial system, a tap on the express primary aerial cable supplies a transformer bank in a nearby vault. Although fuses are in the vault in this study, they may be installed on the pole. The secondary

Open-Wire and Aerial-Cable Systems Have These Unit Costs

Load Kva/Block	Open Wire	Aerial Cable and Vaults			
	Radial	Radial	Loop	Automatic Throwover	Network
100	1.0	3.8	4.5	4.8	6.7
200	1.3	4.4	5.1	5.4	7.5
400	2.1	6.7	8.1	8.6	12.8
800	3.1	10.7	13.5	14.5	22.5

aerial cable on the same pole line is supplied from the vault by a conventional riser conduit.

At 100 kva per block one vault serves two blocks with 500-MCM secondary. To carry 200 kva per block, one vault remains enough for each two blocks, but transformers are 500 kva and secondary cables 750 MCM to meet voltage regulation needs.

For 400 kva a vault housing a 500-kva transformer bank serves each block. At 800 kva an additional vault is required in each block. The secondary from this vault is connected to the 400-kva customer's service, not to the aerial cable. The largest increment in costs for the radial system is a result of increasing the number of vaults.

In the loop system, each vault contains a sectionalizing switch. Aerial cable is routed through this switch, which can feed the transformers from either direction or bypass the load entirely. Transformers are fused, but in other respects this system is identical with radial system for each load level. The unit cost is higher, but cost increments are proportionately about the same.

In the throwover system, a primary transfer switch is substituted for the sectionalizing switch, and taps from two radial-type aerial-cable feeders are brought into the vault. The alternate primary supply is provided by a lateral tap from a feeder on an adjacent street. Unlike the loop system, the lateral tap must have capacity only for the individual lateral load.

The sensing voltage for control of the automatic throwover mechanism is provided by a small 600-v insulated cable bundled with the primary circuit. Potential transformers to supply the sensing voltage may be in any convenient vault. The throwover system is the same as the loop and radial systems in transformer capacity and spacing, but its vault space and unit costs are slightly greater.

Network System Costs Most

The primary circuit of the secondary network scheme is arranged similarly to the throwover system, except that additional transformers and network protectors are substituted for the transfer switches and fuses of the latter. The aerial cable secondary is connected together in a grid and safeguarded by limiters.

The cost relationship of the four systems (see table) remains the same, regardless of load density. Costs of the radial, loop, and throwover systems are not widely separated. But the network system is considerably more expensive because the load densities studied are quite small for such a system.

No particular effort was made to select the most economical design for each system. The high unit cost of transformer stations, however, favors larger secondary mains and fewer vaults.

Cost Differentials Are Significant

Although the cost differentials among radial, loop, and throwover systems are not great, they are significant when selecting a system. And reliability and adaptability are even more important considerations.

In a simple radial aerial-cable system, primary faults could interrupt service to a considerable area for long periods. The feeder would not be available for test or splicing without interruption. The loop system partially eliminates these shortcomings. Although interruptions from primary faults will be as frequent, service could be restored much faster by sectionalizing.

The throwover system offers better reliability than the loop or radial systems. Complete protection is offered for the first contingency. The feeder is available for test or extension to other customers.

The high-cost secondary network goes even beyond the other systems in reliability. Protection is not only offered for primary faults, but transformer and most secondary faults do not interrupt service.

Area Served Should Be Considered

In selecting a distribution system, another basic consideration is the area served. The configuration of the business center may take many forms: It may be long and narrow, as along arterial streets. Parallel aerial-cable routes on adjacent streets or alleys could supply any system previously described, the loop or throwover system being particularly adaptable.

The business area may be small and rectangular, as in isolated shopping centers. Possibly service from only one feeder is available, and the radial or loop systems might be most adaptable. In larger areas a throwover or spot-network system might be more suitable.

Also, consider the adaptability of the aerial-cable-transformer-vault system. In light to medium load-density areas only a few vaults would be needed. Each would require two primary risers for duplicate feed and one or more secondary risers for aerial secondary bus.

As load density increases, the greater are the chances of requiring three aerial cable routes (two primary and one secondary) on one pole line. Suitable locations for the numerous risers then become scarce. Consequently, 600 kva per block of uniformly distributed load is a practical limit for an aerial-cable-and-vault system.

Considering the many factors involved, a loop or throwover system, or a combination of the two, will

be selected. Loop feeders No. 1 and 2 are on adjacent parallel streets; vaults at A, B, C, D, and E are loop fed. They are installed initially or as load develops.

Vault F, on a cross street, has a manually operated throwover switch to avoid deviating the route of the loop feeder. (Cost of a manually operated throwover vault system is comparable with that of the loop system.) Vault G is also a throwover vault serving a load which develops outside the aerial-cable area. Automatic operation of throwover switchs may be used for essential services, such as hospitals.

A particularly good application of aerial cable with vaults is in a congested medium-density business or apartment area served by pole lines in narrow alleys or easements. Satisfactory clearances are not available for open wire in the higher distribution voltages. Thus if conversion to a higher voltage is necessary, aerial cable and vaults should be considered.

Although aerial cable combined with vaults offers a means of deferring the high cost of underground, sound economics dictates that plant investments in any particular system be salvageable to the fullest extent possible. On this premise, cost of underground was compared with the cost of constructing and rebuilding aerial-cable distribution for underground.

For the comparison, an automatic throwover system was selected because it satisfies minimum continuity requirements for underground. Load density was assumed to be 200 kva per block initially and 600 kva at conversion. Based on 15% annual growth, conversion would be required in 7.85 years.

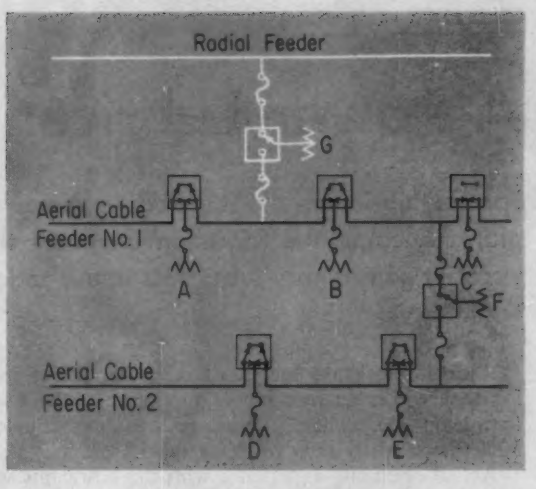
Plant investment for a 600-kva throwover system is 11.5 units, against 15.2 units for a complete underground system (see chart opposite). The average investment difference of 4.3 units amounts to an accumulated difference of 5.1 units in favor of aerial cable, if fixed charges of 15% per annum are considered over the 7.85 years.

But at 600 kva, conversion to underground will cost an extra 7.8 units. Thus total investment in aerial cable and conversion is 11.5 plus 7.8, or 19.3 units. As the actual value of an underground system is 15.2 units, the difference of 4.1 units must be retired without value in about 8 years.

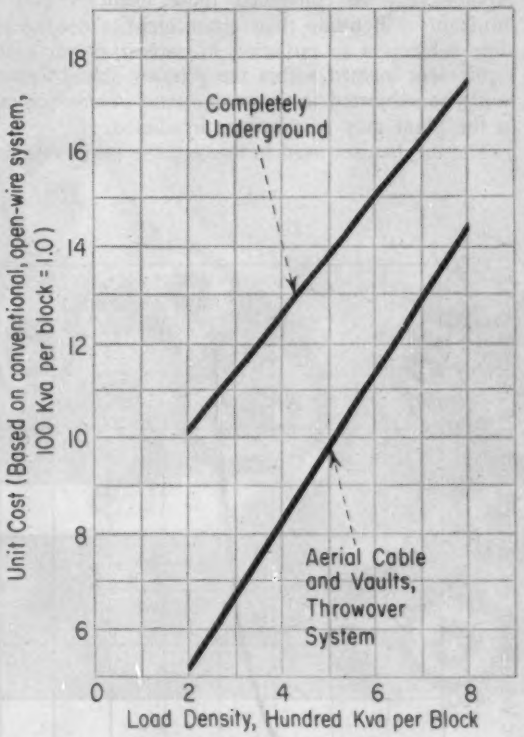
Slow Growth Rates Favor Aerial Cable

Similar comparison, using the same load densities but an 8% growth rate, proved favorable to the aerial cable system at slower growth rates. As the time to conversion was lengthened to 14.3 years and the difference in fixed charges was increased to 9.25 units, the retirement loss remained 4.1. Thus, the ratio of difference in fixed charges to retirement loss favors aerial cable for slower growth rates.

To date, Florida P&L has no installation utilizing vaults and aerial cable as a system complete in itself. But aerial cable has been installed as an express circuit to supply open-wire and underground feeders. Combined with aerial transformers, it serves both residential and commercial areas.



. . . and It's Cheaper than Complete Underground



Short sections of primary aerial cable as radial taps from an underground system are supplying both aerial transformers and isolated vaults. These sections are usually kept short if alternate primary feed is not available. Secondary aerial cable distribution from an underground system has assisted in reducing the investment where a complete underground system is not justified.

A-Power Lubricants Cost 10% More

Special lubricants are needed in A-power plants because the radiation increases the viscosity of ordinary lubricants in use today

Radiation-resistant lubricants have been developed for the British nuclear power program by the Shell Petroleum Co. These lubricants are approximately 10% more costly than ordinary lubricants.

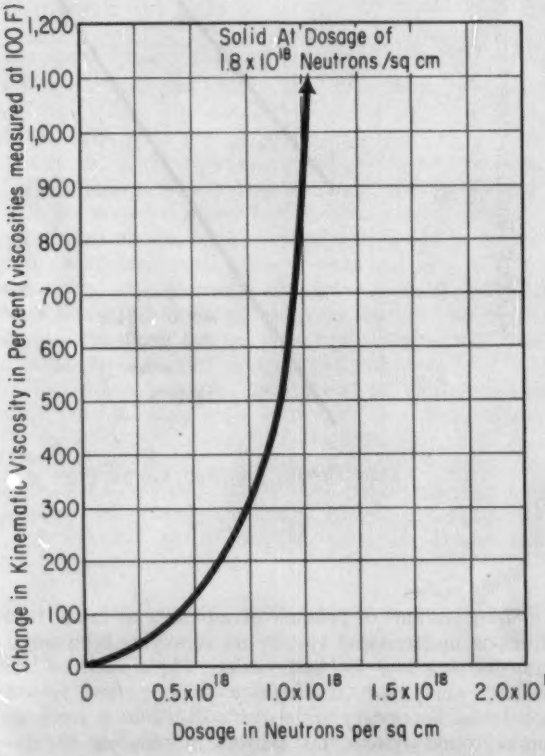
Actual operating experience with the lubricants will have to await operation of the fast breeder reactor at Dounreay, Scotland (EW, Sept. 16, p 106). But extensive laboratory tests, conducted by the British Atomic Energy Authority and the Central Electricity Authority, have convinced these agencies that the lubricants will retain their characteristics despite possible subjection to radiation in nuclear power plants. Equipment located within the primary shield will certainly be subjected to radiation. And other equipment in the plant may at times be irradiated.

The mechanism used in making the lubricants radiation resistant has not been disclosed for competitive reasons. But the new lubricants can be handled in exactly the same manner as ordinary oils and greases when used on non-nuclear machines. However, as they are more expensive to produce, greater care must be exercised to prevent waste.

There is a need for special lubricants in nuclear power plants because the molecular structure of lubricants, as in the case of other materials, can be changed by radiation. Under its influence, molecules can absorb large amounts of energy. As a result, the molecules become "excited" and break down into highly reactive fragments, depending upon their structure. In the case of conventional high-quality lubricants these fragments can then combine with neighboring molecules to form compounds of higher molecular weight. The viscosity of these irradiated materials increases significantly: They may even become solid.

The special lubricants have been developed as a result of a research program started in February 1953.

In experiments, performed in collaboration with British atomic researchers, samples of oils and greases were inserted into a nuclear reactor where they were subjected to a neutron flux of about 10^{12} neutrons per cm^2 per sec for various periods.



VISCOSITY of conventional lubricants increases rapidly when they are subjected to radiation from a Cobalt-60 source

Lubricants were Subjected to Radiation

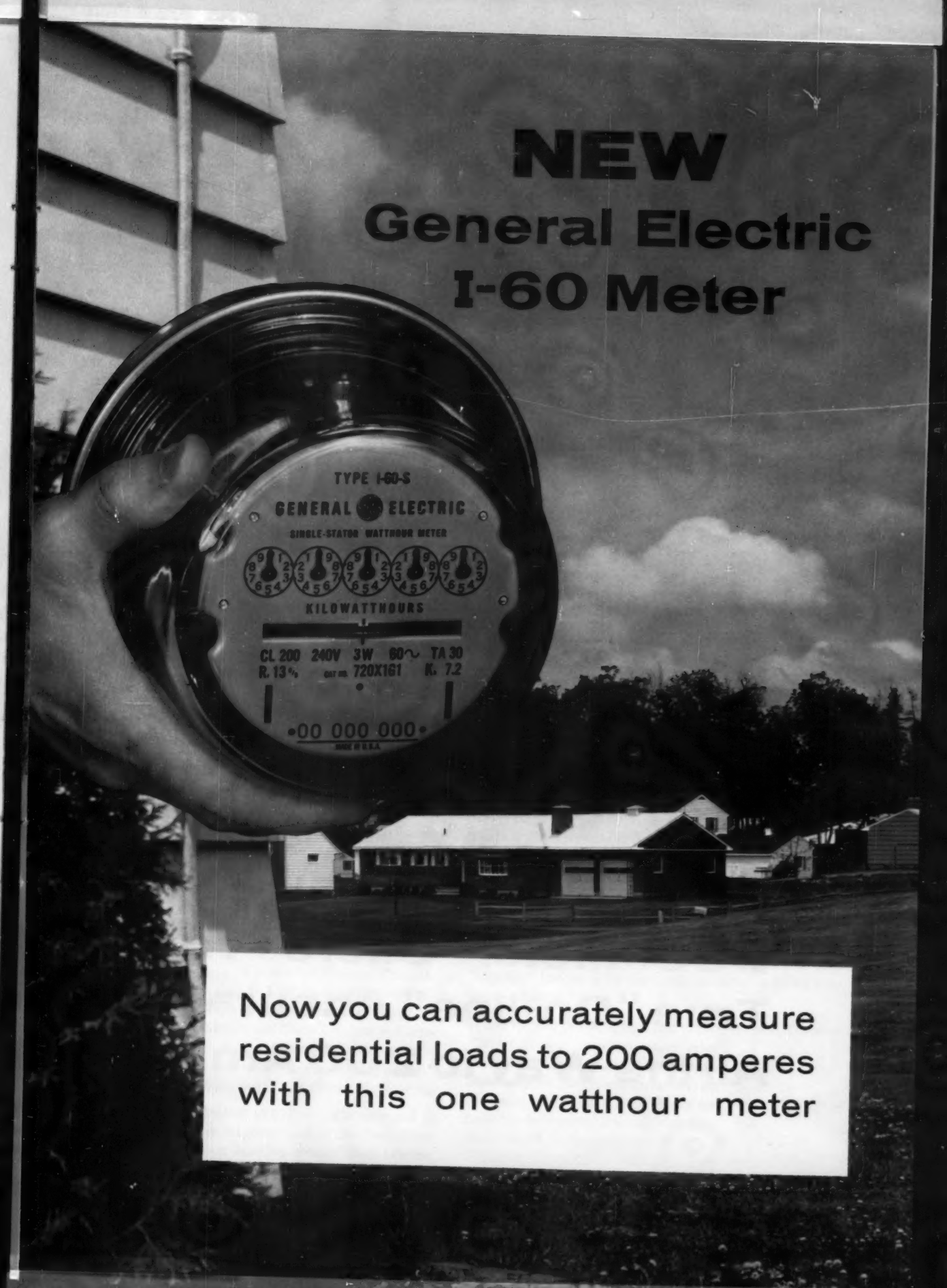
A very large number of materials, including a variety of synthetic as well as petroleum lubricants, were exposed to various dosages of both gamma radiation and neutrons.

During the four years of tests, examination of samples after irradiation showed that many had undergone profound changes in molecular structure and physical properties. For example, certain conventional high-quality petroleum lubricants rapidly darkened in color and increased in viscosity with increasing dosages of radiation. Eventually they were transformed into jelly-like masses, with melting points in excess of 200C. And they were largely insoluble in petroleum spirit, cyclohexane, benzene, acetone ethanol, and ether. Similar effects were observed on some synthetic diesters and silicones.

The radiation-resistant lubricants show practically no change in physical properties at radiation dosages which transform normal lubricants into solids or otherwise make them useless.

Many New Properties Are Required

The new lubricants must have many new properties to meet the requirements of nuclear power stations. Those which may come into contact with the coolant gas of a gas cooled reactor need an extremely low vapor pressure to prevent the contamination of the reactor; others must be capable of withstanding high temperatures for long periods because their renewal may be possible only every several years. In certain reactors lubricant must be compatible with the hot coolant.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NEW General Electric I-60 Meter Offers You True "On-line" Accuracy All the Way to 200 Amps

for your residential loads today and in the future

FOR YOUR SINGLE-PHASE RESIDENTIAL LOADS, the new Class 200 I-60 watthour meter by General Electric gives you "on-line" accuracy at *both* light and heavy loads. This remarkable new meter was designed specifically to meet the expressed needs of metering men for a single-stator meter capable of accurately measuring loads *up to 200 amperes* with a metering investment *no greater* than for existing Class 100 meters.

PROVEN ACCURACY, UP TO 200 AMPERES, is shown by the "on-line" load curve of the I-60 meter. The outstanding characteristic of the I-60 meter is its "on-line" performance at the Class 100 meter test currents of 1.5 and 15 amps, as well as at the Class 200 test currents of 3 and 30 amps. And at a full 200 amps it stays within three-quarters of one per cent. This superior performance of the I-60 is unequalled in the history of metering.

YOUR METER INVESTMENT IS PROTECTED, now and in the future, by the low inherent cost of the I-60 Class 200 meter—an inherent cost no greater than existing Class 100 meters. A revolutionary new, lightweight stator, simple and efficient, contributes to the outstanding accuracy of the I-60 meter. This stator design allows you to benefit from substantial savings in construction and materials selection. With the I-60, you protect your important metering investment by getting a Class 200 meter *genuinely no more costly* than present Class 100 meters.

TIME-PROVEN ADVANTAGES OF MAGNETIC SUSPENSION—a General Electric development—give you greater sustained accuracy, freedom from bearing replacement, and virtually eliminate tilt-error problems. Only G-E meters with magnetic suspension bring you these benefits.

Whether you prefer Class 100 or 200 meters, General Electric has a meter to meet your needs. Ask your G-E Apparatus Salesman or Representative for all the facts on the new I-60. Write for bulletin to General Electric Co., Section 621-11, Schenectady 5, N. Y.

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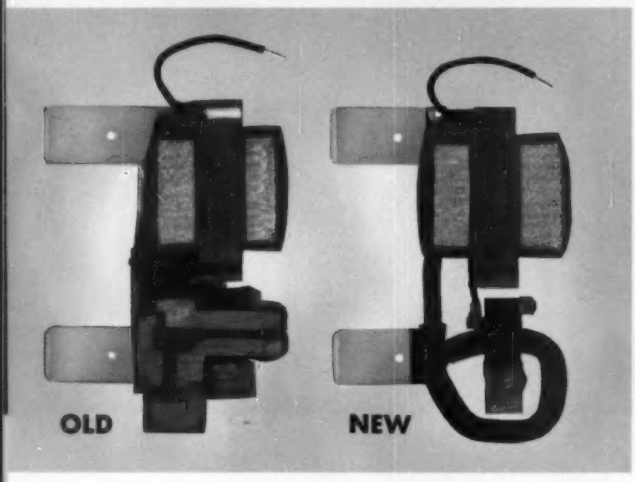
NEW Class 200 I-60 meter is inherently no more costly than present Class 100 meters

UNIQUE NEW STATOR CUTS MATERIAL COSTS IN CLASS 200 I-60 METER

A revolutionary new, lightweight stator design is incorporated in the I-60 meter, making its inherent cost equal to existing Class 100 meters. Comparing this I-60 stator to conventional Class 200 designs, there are substantial savings in copper and iron. Compromises in core designs and materials are eliminated by the simplified current coil and magnetic isolation of current and potential electromagnets. Spacing the potential-return laminations away from the current core eliminates undesirable intermingling of potential and current fluxes. Thus each electromagnet can best perform its measurement task.



The new current coil design is very simple compared to conventional split-coil designs found in other Class 200 meters. The elimination of current splitting minimizes error torques, inherent temperature errors, potential circuit losses, and undesirable effects on the phase angle of the potential flux. The new I-60 current coils are not fastened to the current core. Their new location and configuration permit optimum alignment of terminal blades in socket clips without affecting calibration. This creative engineering makes possible the I-60 meter's unprecedented accuracy all the way up to 200 amperes.

NEW I-60 OFFERS MAGNETIC SUSPENSION AND OTHER I-50 METER FAMILY BENEFITS

The benefits of magnetic suspension—a General Electric exclusive—are yours in the I-60 meter. With magnetic suspension, G-E Class 100 and 200 meters offer greater sustained accuracy, freedom from bearing replacement, and virtual elimination of tilt errors. Other I-60 features time-proven in the I-50 meter family are corrosion resistant finishes, coordinated insulation, and easy-to-read faceplate.

For complete details on Class 100 and 200 meters contact your G-E Apparatus Salesman or Representative or write General Electric Company, Section 621-11, Schenectady 5, N. Y.

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Table I

	220 kv Line to Ground (345 kv phase to phase) μa indicated, ft.				
Live metal to contact point	12	9	8	7.5	7
Shielded lead only—readings	7	21	31	...	51
Lead plus body contact—readings	35	61	85	115	
Lead plus body, no contact with tool	35	61	86	111	

Table II

	330 kv Transmission Line μa indicated ft.		
Live metal to contact point	12	9	8.5
Lead plus body contact—readings	40	62	74
Reading without touching tool	40	59	70

TRANSMISSION—Testing

Develops Test for Hot Sticks for EHV Work

D. C. HUBBARD, Chief Engineer, Hot Line Tools, A. B. Chance Co, Centralia, Mo.

The introduction of 330 and 345-kv transmission brought with it the problem of hot-line maintenance, requiring the development of proper tools. The mechanical difficulties were not great, but the tool designers had to deal with the pattern of induced and leakage currents associated with insulation factors and proximity to EHV conductors. They had to deal also with the problem of the possible influence of corona on hot-line tool design.

Distances Important

Leakage currents across a hot stick are complex and involve a number of factors. The latter include the resistivity of the tools' materials, surface leakage behavior, the dielectric factor of the materials, the potential gradient along the tool to the point of body contact, and the influence of the field intensity at the operator's station, particularly as he moves about in performance of his work.

Fortunately, structure designs provided extra distance between insulator strings and their tower arm areas, where men must be stationed. These distances and working areas are important to the lineman's safety and comfort.

Initial tests at the high-voltage laboratory of the Ohio Brass Co used a suspension insulator string with hardware designed for EHV transmission. Tests were made at 200 kv to ground (345 kv phase to phase) and at 220 kv to ground (380 kv phase to phase).

To determine the degree and direction of corona discharge from the tool head, a 12-ft plastic-coated spruce pole, fitted with ferrules of conventional design and conventional fittings, was placed against the conductor outside the protective influence of gradient shields. The but end was grounded. The test voltage was increased in the room darkened to permit observance of corona.

Ferrule Studied

This test established that conventional ferrules at the head end of hot sticks were unsatisfactory. Corona discharged downward parallel to the tool handle, and insulation was damaged at the pole end of the ferrule. On the other hand, a modified ferrule directed corona discharge at 90 deg to the pole handle and eliminated damage to insulation.

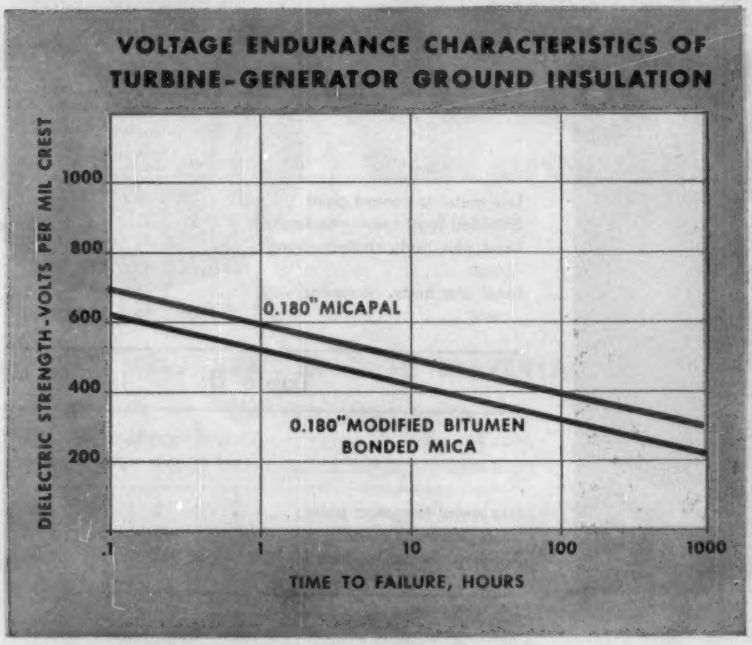
The magnitude of currents to ground was investigated at various intervals along the tool handle. These measurements were made with a shielded meter lead:

Measurements Taken

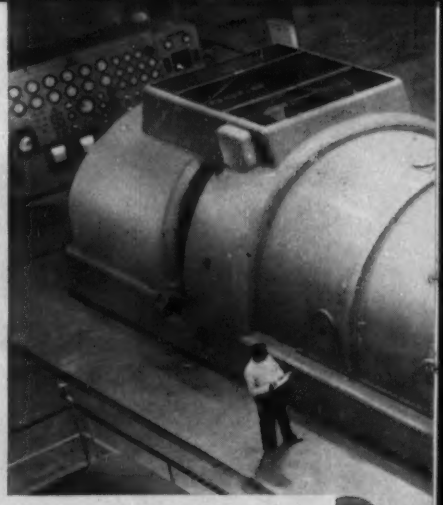
1. In contact with the tool handule and no one in contact with the tool;
2. In the uppermost hand of an investigator holding the tool handle;
3. In the uppermost of an investigator after he had released his grasp on the tool but maintained his position with relation to the conductor.

Average values recorded, shown in Table I, compare closely with measurements in Table II, taken on a 330-kv steel tower line during a hot-line tool demonstration. Measurements in Table II were taken with a lineman holding the shielded

(*Continued on page* 110)

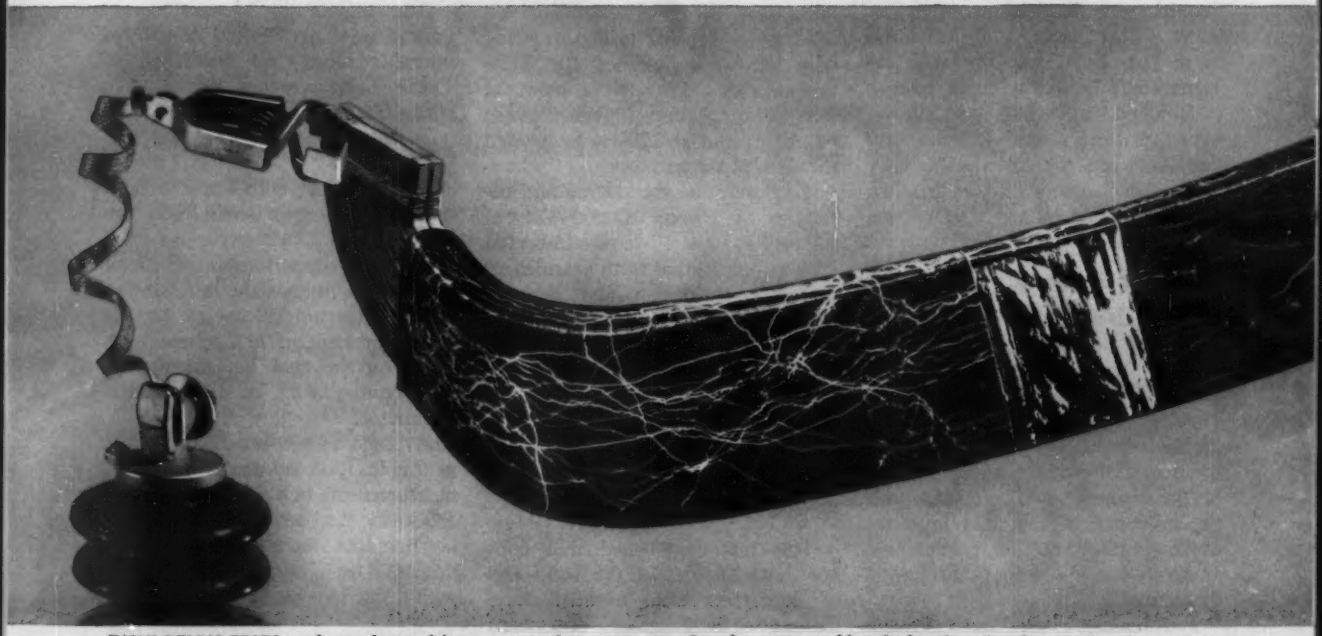


SIGNIFICANT IMPROVEMENT is noted in voltage endurance obtained for any duration of voltage application on Micapal compared to presently accepted generator insulating material. This improved voltage endurance increases long-term turbine-generator availability.

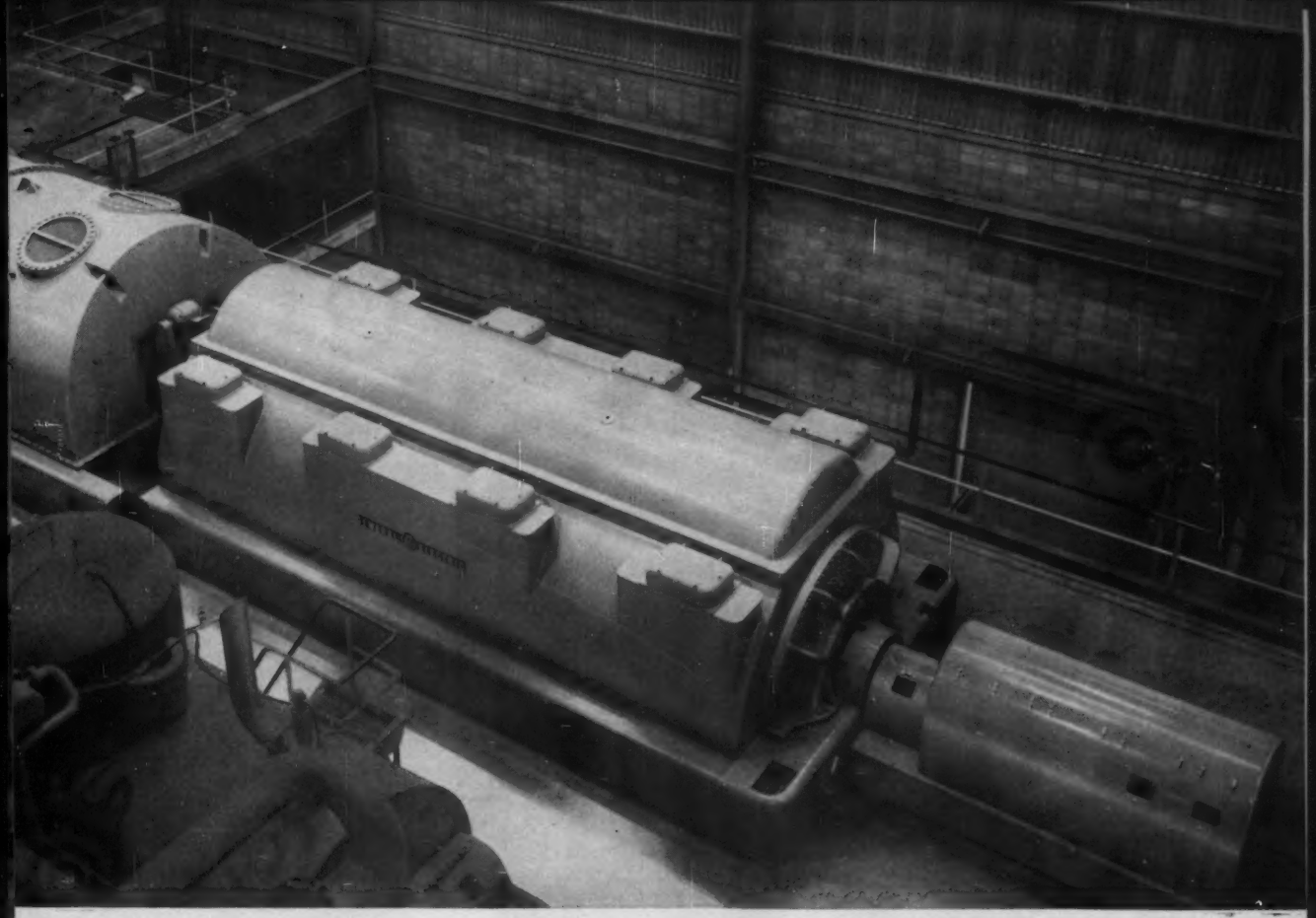


MICAPAL INSULATION better withstands high voltages and variable stresses caused by differential thermal expansion and contraction in large generator stator windings. Micapal is used on this 183,824-kva generator installed at Pacific Gas and Electric's Morro Bay Station.

How General Electric Micapal



INSULATION TESTS such as pictured here are used to compare the dielectric breakdown of different insulations. Forced to carry voltages far above their rating, test bars of various types of insulation first develop corona streamers, then finally fail, enabling engineers to measure the insulation's actual voltage endurance.



insulation extends generator life

IMPROVED INSULATION BETTER WITHSTANDS HIGH VOLTAGES, VARIABLE STRESSES

Now, after extensive research and four years of operating experience, General Electric announces the extended application of Micapal insulation for high-voltage stator windings. A major advance in providing still longer, more reliable operation, this mica-based insulation offers these distinct advantages:

Greater Tensile Strength. Micapal incorporates mica mat and some mica flake bonded with a duplex thermosetting resin. Mica mat is finely divided, reconstituted mica formed into sheets. The thermosetting binder, combined with uniform mica structure, makes Micapal much tougher at operating temperatures than earlier insulations.

Greater Dimensional Stability. Micapal is molded to the precise shape of generator armature bars. Because of thermosetting qualities, the insulation won't flow or lose shape. It possesses great mechanical strength over the full range of operating temperatures.

Improved Thermal Conductivity. Micapal removes heat from electrical conductors more easily. The result is that for a given current and same insulation thickness, the armature bar runs cooler.

Improved Dielectric Breakdown Strength. The voltage endurance characteristics shown on the chart, above, illustrate how Micapal insulation withstands a much higher voltage than other mica insulation for any given period of time. The impulse puncture structure of Micapal has been shown by laboratory tests to be higher by an even greater factor.

Improved Micapal insulation is just another example of General Electric steam turbine-generator progress in meeting tomorrow's power demands. For more information on new generator developments, write Large Steam Turbine-Generator Department, General Electric Company, Schenectady 5, New York.

254-41

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This single frame from a high-speed movie taken during developmental testing dramatically shows the action of the new G-E load-break device. The line sketches at the right describe this action in detail.

NEW load-break device in General Electric's enclosed fuse cutout interrupts circuit automatically!

Now for the first time you can get an efficient enclosed fuse cutout load-break that can be opened under full rated load—conveniently and economically. A high pressure blast of insulating gas blows out the arc automatically in 3 to 7 cycles.

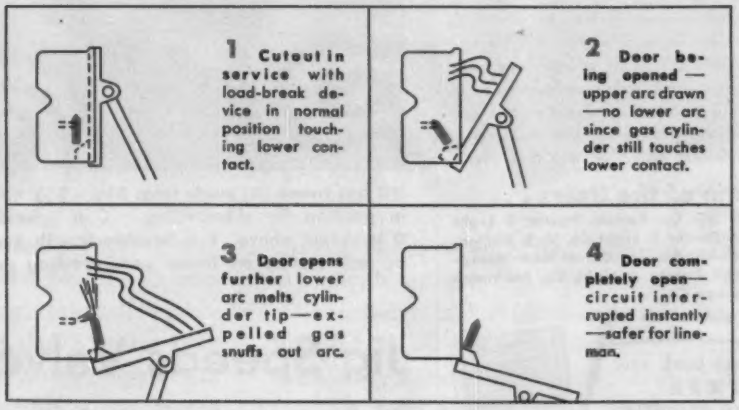
The lineman has good protection and the new load-break feature enables General Electric fuse cutouts to do double duty by replacing more expensive switching devices, thus saving on system investment.

Arc-quenching gas is supplied by a tiny replaceable cylinder of non-corrosive metal that fits in a socket under the lower contacts. After each operation, lineman easily slips in new cylinder, then exposes a reflective indicator on the door to show that the cylinder is in place. Cylinders come in handy plastic clips that hold six and can be attached to the lineman's belt or tacked on the pole near the cutout.

General Electric fuse cutouts with the new load-break are now available in 100-ampere normal, heavy, and extra-heavy duty types.

For more information on this new General Electric development contact your nearest G-E Apparatus Sales Office, or write for Bulletin GEA-6208 to General Electric Company, Section 433-21, Schenectady 5, New York.

out- automatically!


1 Cutout in service with load-break device in normal position touching lower contact.
2 Door being opened — upper arc drawn —no lower arc since gas cylinder still touches lower contact.
3 Door opens further lower arc melts cylinder tip—expelled gas snuffs out arc.
4 Door completely open—circuit interrupted instantly —safer for lineman.

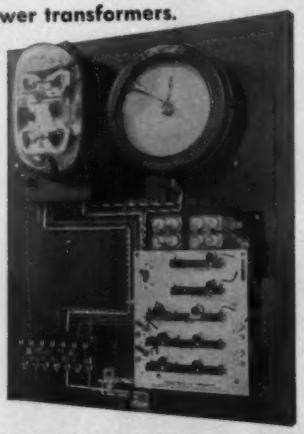
Progress Is Our Most Important Product

GENERAL ELECTRIC

Transformer Loss Compensator

Saves you Money!

BECAUSE it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the power transformers.



This installation at 2.3 kv saved about $2600 compared with 34.5 kv metering; it saves about $5500 over metering at 69 kv.

THE TESCO compensator adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . importantly . . . no changes are made in the meter itself, either structurally or in adjustments . . . It is produced in two and three element types for use with two-element or three-element meters on any type circuit.

Some of the Users . . .

Phila. Electric Co. Penna. Power & Light Co. Texas Power & Light Co. U. S. Bureau of Recl. Public Service Co. of New Hampshire. Utah Power & Light Co. Northern States Power Co.

Get your book now. FREE

Detailed information on operation, installation, applications. Write for Bulletin NO. 63-A.

EASTERN SPECIALTY CO.

PHILADELPHIA 40, PA.

Tests Hot Sticks

(*Continued from page* 105)

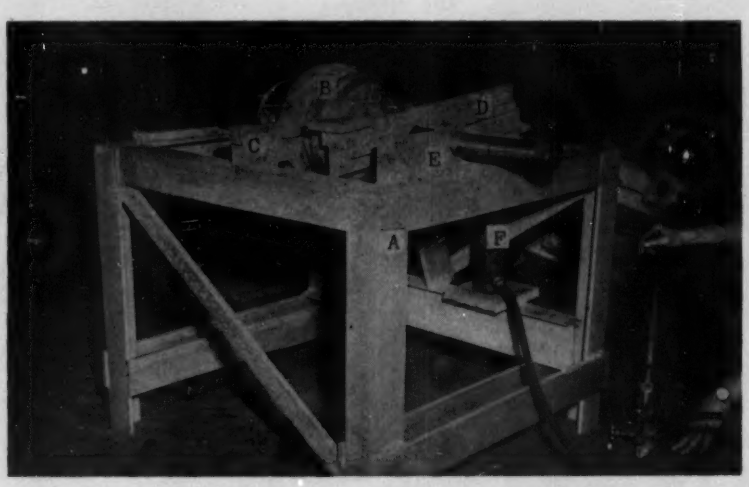
meter lead in the extended hand gripping the tool. These values are influenced by the position of the operator with respect to the conductor. The values given are for readings taken with one arm extended in a normal working position. Moisture content was 8½%.

Test results indicate that it makes little difference in current values observed whether the operator is in contact with the tool handle or not. But, when current values exceed 100 μ, a vibratory sensation, referred to by linemen as "fuzzy," became noticeable upon initial light contact with the tool. Current values generally above 300 μ produce tingling. These reactions are in agreement with data presented by K. S. Geiggs in his AIEE paper 56-948, "Electric Shock Hazard Analysis."

The tests indicate that to remain below the 100 μ level, generally considered the upper allowable limit for hot-line work, a minimum insulation length to live metal on conductor supporting tools should not be less than 8½ ft for work at the 345-kv level. Hand tools should be at least 12 ft long with safety hand guards 9 ft away from the head ferrule. This distance takes into account the operator's proximity.

These tests indicate the degree of safety provided with tools properly cared for and protected from dirt and moisture accumulation, and the correlation between laboratory and field data. Tools, designed from data obtained in these studies have been in use on 330/345-kv circuits for more than two years.

GENERATION—Maintenance



JIG has frame (A) made from 3½ x 3½ x ⅜-in. angles. B is intercepting valve in position for dismantling. C is split-clamping ring for hold valve cap. D is shown above. E is headstock with 2-in. nut welded. F is 20-ton hydraulic jack resting on frame pad, pressing on pad on screwdriver's lower side

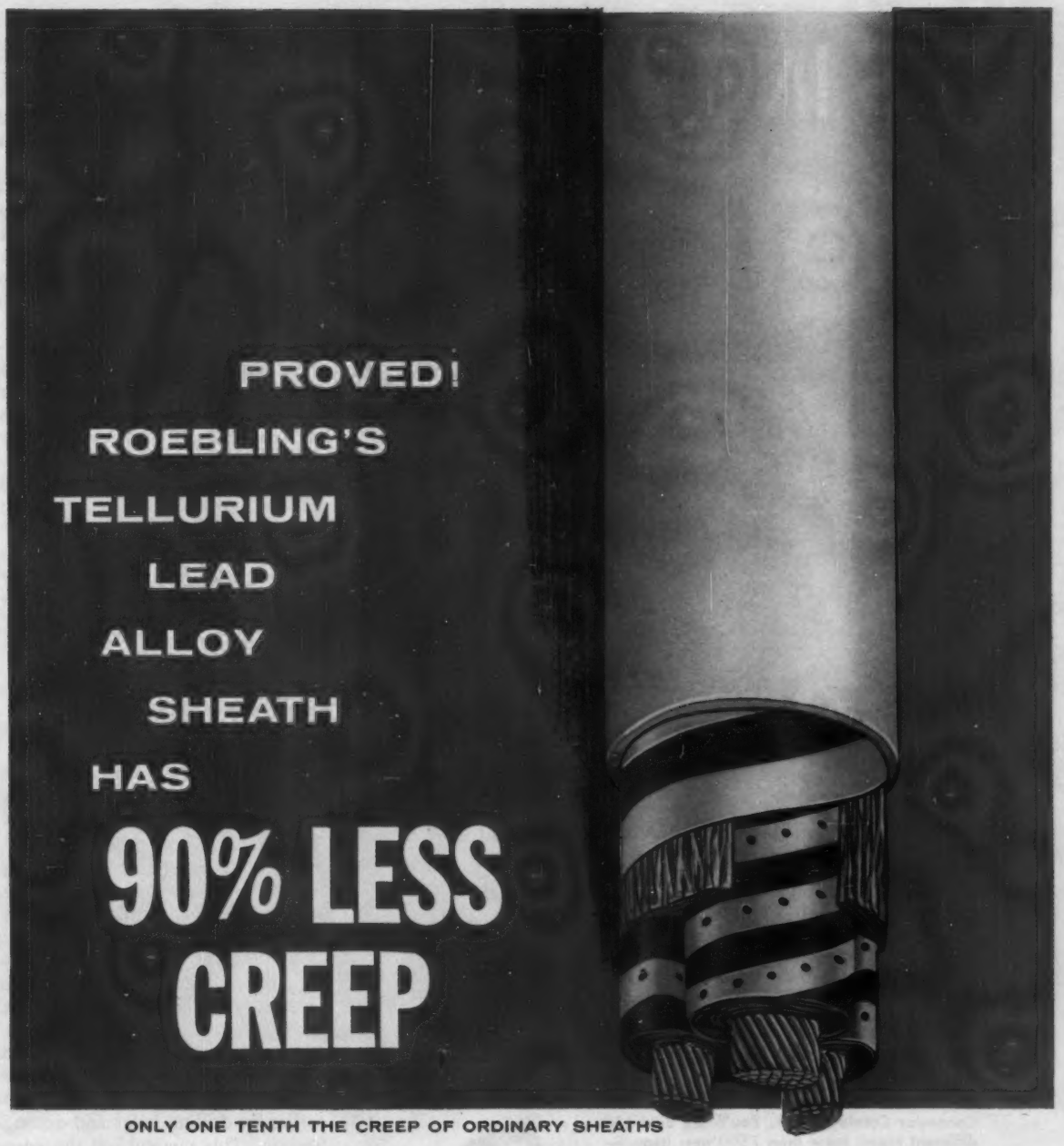
Jig Speeds Valve Dismantling

WILLIAM R. HAYES, Master Maint. Man, Sporn Plant, Central Operating Co, New Haven, W. Va.

A special jig (illustrated) saves Sporn Plant maintenance crews materials, manhours, and manpower in dismantling turbine intercepting valves.

Formerly this job, especially removal of the valve nose from the cap, was time consuming. The

(*Continued on page* 112)



ONLY ONE TENTH THE CREEP OF ORDINARY SHEATHS

Thousands of feet of Roebling Paper Power Cable with Tellurium Lead Alloy Sheath now in service bear out Roebling's exhaustive laboratory tests. This unusual sheath creeps only one tenth as much as ordinary copper-lead sheath! What's more, tests prove this sheath has 4½ times more bending life... outstanding stability under heat... retains excellent ductility year after year.

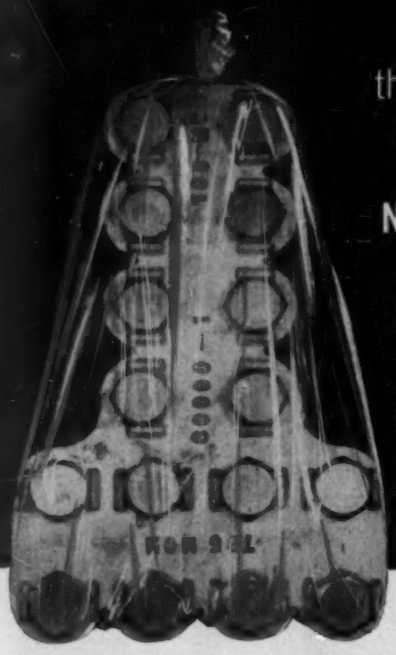
Sound good? It is—and so is the unexcelled paper power cable inside! In fact, if you're thinking about dependability *tomorrow*, as well as today, investigate this superior cable.

Get test data and an informative folder about Roebling Paper Power Cable with Tellurium Lead Alloy Sheath by writing Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

IT'S IN THE BAG



the finest aluminum power connector ever made... **NOW PACKAGED** to insure positive, dirt-free contact surfaces

Every aluminum connector in Royal's outstanding new line is now *individually packaged* in its own polyethylene bag immediately after the oxide inhibitor is applied. From manufacture to installation, *not one* speck of dirt or foreign matter can reach the contact surface—you get *full* conductivity, always. This is another example of the "Royal" treatment.

The new aluminum connectors themselves have *exclusive* HEAVY-SERIES BOLT CONFIGURATION for *highest* clamping force with *lowest* connector stress.

Get all the facts in Royal's new Aluminum Connector Catalog No. 1. You'll see over 150 different types, more than 7500 new items — and it's sectioned and tabbed for fast selection. A special section contains tables, charts and valuable engineering information . . . plus estimating and planning helps. Write Royal on your company letterhead today.

ROYAL

A part of the arsenal of AMERICAN POWER PRODUCTION

ROYAL ELECTRIC MANUFACTURING CO., INC.
1122 EAST 87TH STREET • CHICAGO 19, ILLINOIS
Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

Jig Speeds Dismantling

(*Continued from page* 110)

threads of the nose and cap "froze" together. To separate them, about 50 lb of dry ice was used on four valves to shrink the inner threads, and tremendous heat was needed to expand the outer threads. During the hot-cold applications, each valve was held in a make-shift clamp. The threads were broken loose with chain tongs attached to the machine-shop hoisting cable, assisted by sledging.

The new jig was used during a recent outage. It clamps the valve cap securely while the "lever-type screwdriver" (D) is actuated by a hydraulic jack (F) after initial sledge blows on the opposite end of the lever jar loose the "frozen" threads exposed to dry ice on the inside and heat on the outside.

The jig, less heat, and half as much dry ice as formerly now dismantle four valves in 3 to 4 hr less time.

GENERATION—Construction

Hacksaw Device Speeds Draft Tube Repair

A double-bladed portable hacksaw device permitted Canadian Niagara Power Co to make a difficult cut through an 8-in.-thick cast-iron draft-tube flange on a turbine at Rankine Hydro Station, Niagara Falls, Ontario.

A 2-in. ring was cut from the circumference of the 5-ft-dia draft tube to restore an expansion joint that had closed up. The problem of restoring expansion space was made more difficult because the same problem had been met 12 years earlier by drilling holes and driving wedges. This method left the edge of the pipe rough and difficult to cut.

The cutting device consists of two 24-in. hacksaw blades, mounted parallel and powered by a small air motor. The motor pushes and pulls the blade at 40 strokes per min. The device follows an angle-iron guide around the pipe at a rate of 1 ft in 4 hr. The two men operating the saw—one inside and the other outside the pipe—communicate by telephone. The device was developed by Orrin Steele, supervisor of mechanical maintenance, and Alvin E. Putnam, planner.

ON THE LINE...

New Hubbard Faultmaster Keeps Pace With Growing Systems!

Small bore single vent tube provides high pressure positive expulsion. Fibreglass reinforcing assures long tube life.

Proper application of fuse cutouts is greatly simplified by the use of the new Hubbard Faultmaster. The design leads the industry with a new single vent, small bore, fibreglass-reinforced fuse tube. Flippers, flying caps, tricky vents and other remedial accessories are not required. Without "blind spots," the Faultmaster is able to clear faults from a few amperes through its maximum rating. Future obsolescence can be avoided now, for the great flexibility of the Faultmaster provides superior protection for today's system and, without extra cost, has the built-in-reserve for operation on the system of tomorrow.

Unique, high strength recoil members and husky fasteners absorb, minimize and distribute the stresses of high fault interruption over the sturdy, solid porcelain column. The entire current path is silver plated and current transfer points are under spring pressure. Springs are made from non-aging materials and designed to operate well below their elastic limit to insure positive contact pressure throughout the useful life of the cutout. All working parts are of corrosion free non-ferrous materials. Get the full story today from your Hubbard distributor or write for a copy of Bulletin P-756.

HUBBARD AND COMPANY

Pittsburgh 1, Pa.
Chicago, Ill.
Oakland, Calif.
Plano (Dallas), Texas

Detroit Toys With H-F Street Lighting

Detroit Public Lighting Commission has been operating an experimental high frequency street lighting system for about nine months. Results so far point to higher efficiencies, reduced ballast weight, less internal heating and higher light output.

Fifteen fluorescent luminaires operate on the specially designed system. Power input frequency is 60 cps; this is stepped up to 360 cps using magnetic frequency multipliers and a pf-correction unit.

Here's what the Detroit tests reportedly indicate:

- Ballast weight—reduced as much as 75%.
- Lamp output can be upped from 13-18% at a lamp current of 1.75 amp, using special series ballasts.
- Over-all increase in lamp lumens is 10% in summer and 20-23% in winter.

Why is Detroit PLC running the tests? Increased vehicle speeds is the big reason. Faster cars need more light on the street for better safety. One method of getting better lighting levels, according to H. F. Wall, general superintendent of Detroit PLC, is to boost the output of each lamp. To test his ideas, Wall had the experimental system put in. Both Detroit PLC and General Electric Co., who furnished the system, feel further testing will contribute to better street lighting.

KG&E Customers Design 'Pattern Homes'

Utility polls its home-buying customers to find out what features they want in an all-electric home, then lets them design it

Kansas Gas & Electric Co is surveying its customers to find out what they want most in new homes. When the survey answers are in, KG&E will build two new all-electric "Pattern Homes" to demonstrate these most wanted features.

Panels Will Design Homes

The survey, which covers the Wichita area, is under the aegis of General Sales Manager K. M. LaRue. He plans to form two panels of 40 or 50 prospective home-buying couples who will actually design the homes on the basis of the survey returns. Says LaRue: "Plans and specifications for the two all-electric Pattern Homes will be decided strictly by the panel members. KG&E will build the two homes to show home buyers how to get the most wanted features at the lowest cost by using electricity throughout. The two homes should establish a pattern for future building in our service area."

Other Pattern Home facts:

- One home will be in $12,000 range; the other $20,000.
- Homes will meet the utility's Live Better Electrically Gold Medallion standards for wiring, appliances, lighting and year 'round climate conditioning.
- Local builders, architects and contractors will be asked to sit in on final panel discussions to suggest the best ways of getting what the panel members desire.

Home-Buying Couples Surveyed

KG&E is surveying couples buying or known to be in the market for a home in one of the two price ranges. Total surveys sent out: 600. Results should be available in the early part of 1958.

Survey questionnaires cover more than desired electrical features. Questions ranging from "How often do you entertain?" to "Do you want a bathroom in the basement?" are included in an effort to sample the new home tastes of Wichitans.

After completion of construction, the homes will be retained by KG&E as long as they can be used effectively to promote LBE.

Look Announces Awards for Wiring Promotion

Look Magazine has recently announced its awards for wiring promotion programs. Competition is open to:

- Utilities having more than 250,000 meters.
- Utilities having less than 250,000 meters.
- Electrical contractors.
- Electrical distributors.

The magazine will distribute detailed information within the next few weeks. However, information may be obtained now from R. Diston, Look Magazine, 488 Madison Ave., New York 17, N. Y.

(*More Selling on page* 116)

BEEP
BEEP
IT SAYS
THEY'RE CELEBRATING
THE TENTH ANNIVERSARY
OF THE PENNSYLVANIA
POLE STAR
DISTRIBUTION
TRANSFORMER
IN CANONSBURG,
U.S.A.

(*Continued from page* 70)

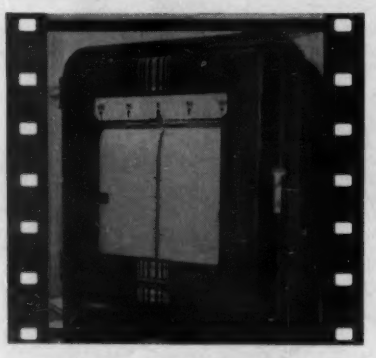
"Something that's never been done..."

the sub-15 cycle preferential rates apply. In such cases, oscillator frequency is 9-15 cycles with performance identical to the 18-30 cycle models.

Reliability

L&N engineers ran two and one-half years of field tests over microwave, power-line carrier and leased communications facilities in order to provide the "peace-of-mind" dependability so characteristic of Leeds & Northrup instruments.

Call us at our nearest District Office, or (in Philadelphia) DAvenport 9-4900, extension 212 — let one of our control specialists give you the full story right now. Or if you prefer, write for more data to 4938 Stenton Avenue, Phila. 44, Pa.



Using new L&N Telemetering System, automatic load controls now start pulsing generators in less than 0.5 second.

The Servel A.C. Purchase . . .

. . . why it was done and what it means in the future competitive situation is sketched by Arkansas Louisiana Gas exec: their dollars and plans prove they want to get the business

". . . Summer cooling market offers both a profitable opportunity for the gas industry and a means of combatting the electric industry's drive for winter heating load through the heat pump. However, the gas companies themselves must take on the prime responsibility for connecting the air conditioning load, providing adequate service and maintenance, and for merchandising too."

So begins a feature article by J. C. Hamilton, president, Arkansas Louisiana Gas Co, in a recent issue of Gas Age. Entitled "Why We Bought the Servel A. C. Division," Hamilton's story recoups Gas's position in the air conditioning picture, and then goes on to say what they must do to make it better. It has some forboding notes for electric men. Listen:

"Having become convinced that gas air conditioning was an absolute necessity for the industry, and with the failure of Servel's marketing efforts in mind, we concluded that a gas company that had the support and active assistance of the industry could develop the business successfully where Servel had failed . . . Offers of assistance and cooperation from the gas industry since the purchase offer was made, have assured us that the required support will be forthcoming.

Gas Co's Have Incentives

"The companies have the greatest incentive—attachment of a very desireable additional load and the blocking of the electric competition —and they can install and maintain the units at the lowest cost to the customer . . . I urge you wherever possible to take on the sales job and where you cannot sell the equipment at least handle the service of it."

Hamilton goes on to describe the organizational set-up resulting from his company's purchase of Servel's A. C. Division (EW, Sept. 9, 1957, p 82). A new company, Arkla Air Conditioning Corp, has been formed to own the properties and conduct operations. In addition to manufacturing the Servel "Sun Valley" unit, of which Hamilton calls "the most significant development in the air conditioning situation," Arkla will carry our extensive programs of training (service schools), research, warranties, pricing and advertising and promotion.

$1,000,000 for Promotion

The promotional plans are big. Here's what Hamilton says about them: "Our study of the previous experience of Servel, and of the future competitive requirements of the industry have made it evident that large amounts must be put into national advertising and promotion and into the research and development program. Initial working capital will be *in excess of $1,000,000 and a greater amount will be required as production increases.* We estimate that the manufacture and sale of a minimum of ten to twelve thousand units per year will be required to justify the large expenditures necessary to the success of the new company."

FHA Rule Helps A.C.

Room air conditioners will be taken into account in determining the market value of a home, under a new FHA ruling. The agency also came up with a new ruling regarding monthly expense of air conditioning which should give the industry an assist in getting into the market.

(*More Selling on page* 120)

NOW!

Service-Entrance Compression Sleeves with . . .

HIGH-VISIBILITY IDENTIFICATION

Chance Service-Entrance Compression Sleeves can be quickly identified in the field because of the easy-to-read, color-coded tapes used on both ends of the sleeves to indicate the conductor sizes on which the sleeve can be used. The same wire-size color-coding is used on the sleeve boxes to simplify identification on the line truck or storage shelf.

Both sleeve and box are color-coded and plainly marked with conductor sizes

Contains z.l.n. 100 to prevent corrosion and improve conductivity

. . . This is particularly important when making bimetal connections. As service connections are usually taped, the z.l.n. 100 Electrical Contact Aid protects against crevice corrosion caused by condensation of moisture. Plastic caps keep the compound in the sleeve. A metal wall in the center of the sleeve acts as a stop, insuring that both conductors are installed to the proper depth. The wall also eliminates the possibility of forcing the z.l.n. 100 out the opposite end of the sleeve when the conductor is inserted. Chance Sleeves are available for conductor combinations from #6 stranded to 1/0 aluminum, ACSR, or copper. Choice of ½" or ⅝" O. D. sizes for installation with standard compression tool. The diameter is clearly marked on each sleeve.

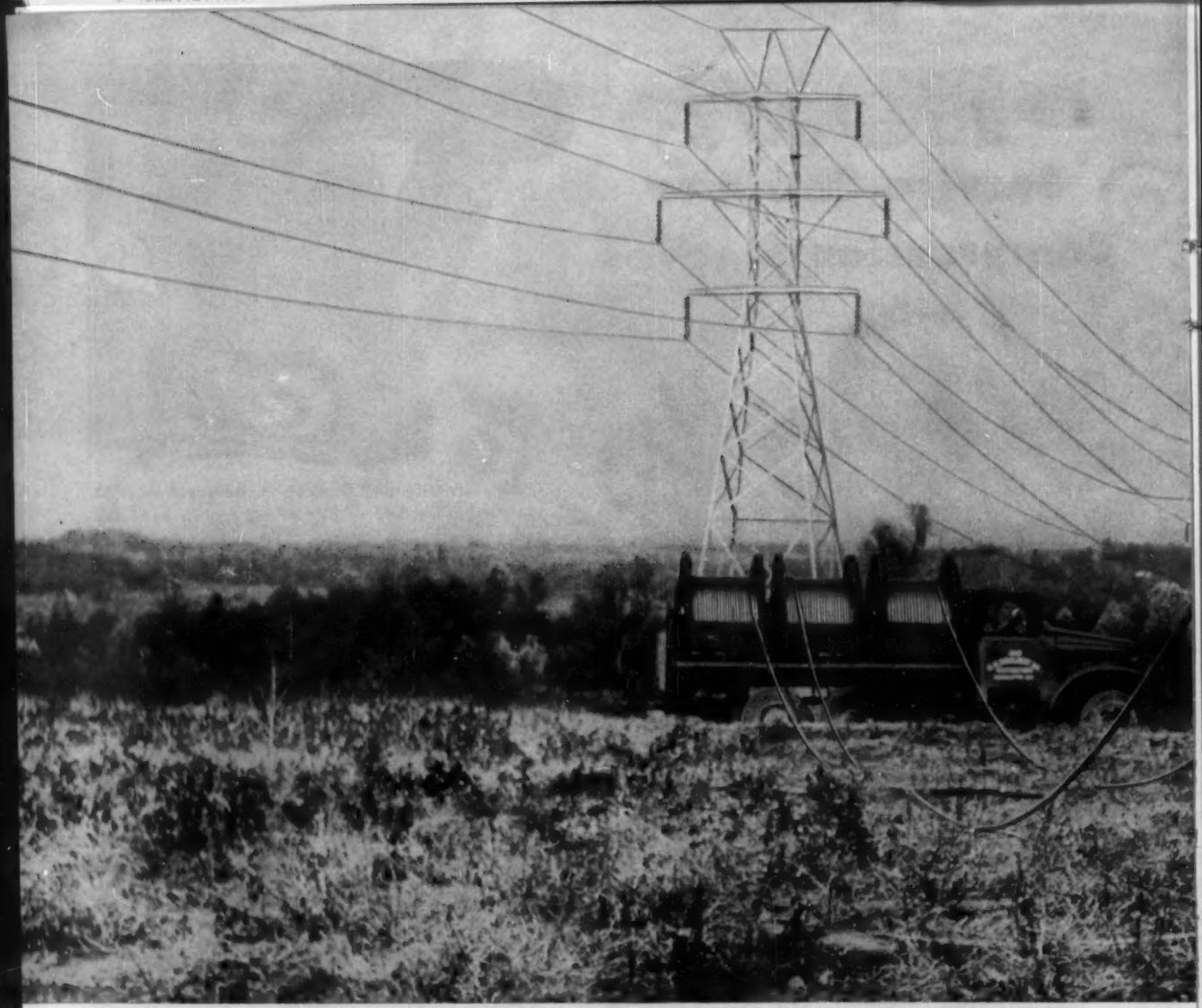
See your Chance Distributor for service—write

A·B·CHANCE CO·

GENERAL OFFICES: CENTRALIA, MISSOURI

for detailed information

CC57-15

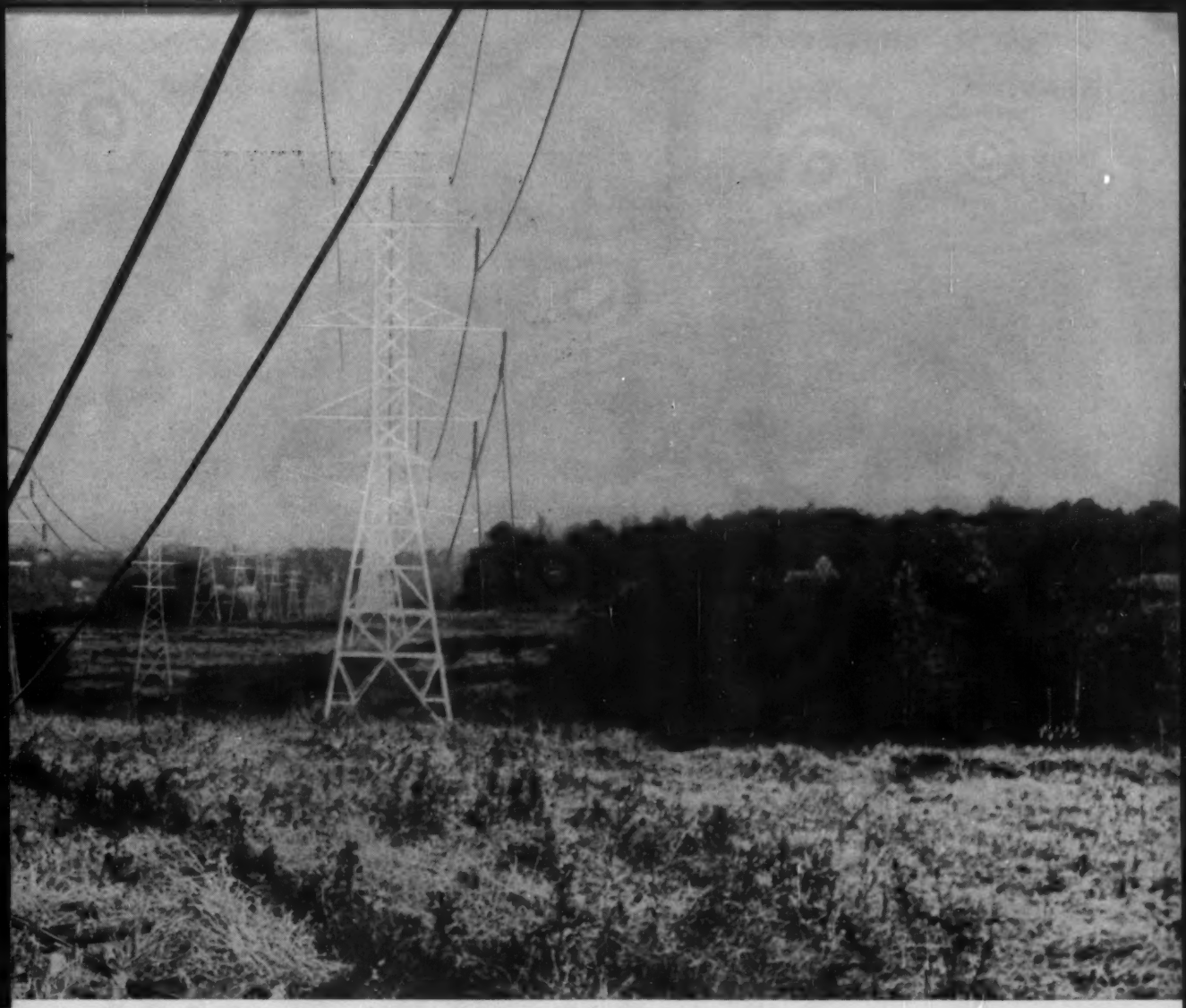


ANACONDA ACSR was installed over large segment of Duke Power Company's 75-mile,

ACSR? Put Anaconda's 50 years of trans

From the very finest engineered product . . . to superior workmanship . . . to on-the-job assistance . . . there is no one better prepared to serve you today with ACSR than Anaconda.

UNIQUE THREE-REEL TRUCK was used to install cable—795 Mcm, 26/7 ACSR from Anaconda. Three reels at once sped work.



230KV Riverbend-Tiger Line. Here, you look west of Kings Mountain, S. C.

mission cable experience to work for you

Producing top quality transmission cable requires more than a ready supply of metal—copper or aluminum. The most vital ingredient of good cable is the manufacturer's *cable experience.*

The choice of metals may change, depending on economic or other considerations. But cable requirements and the skills and knowledge involved in making dependable transmission lines do not. Whether copper or aluminum . . . it will pay you to call on the Man from Anaconda.

Backed by the broadest line of wire and cable in the industry, in both copper and aluminum, he is best qualified to help you arrive at the most practical and economical answer to your cable needs.

Multi-mill manufacturing facilities – strategically located across the country – assure speedy service. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

P.S. TECHNICAL ASSISTANCE. Anaconda field engineers have worked in advisory capacity on hundreds of complex jobs. They are ready to put their experience and knowledge to work on your problem.

Ask the Man from ANACONDA®

for ALUMINUM WIRE & CABLE

Well diffused 115-ft-c illumination . . .

replacing high contrast lighting . . .

Spurs Transformer Production, Cuts Rejects

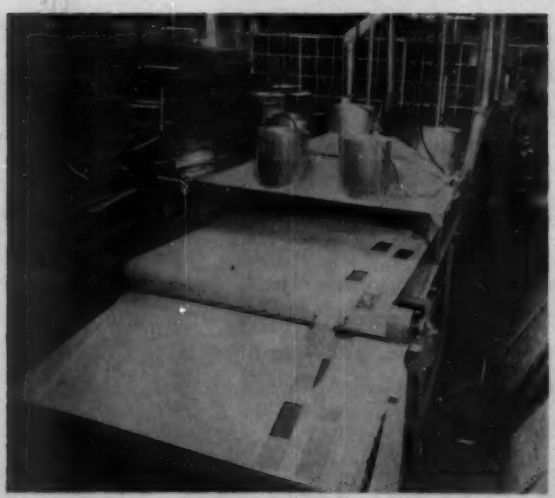
W. H. SERVARY, Power Sales Engineer, Baltimore Gas & Electric Co, Baltimore

Higher production, fewer rejects, and a big improvement in employee morale—all the results of a new lighting system installed in the transformer division area of the Airpax Products Co, Middle River, Md. Bathing the room in a softly diffused light that averages 115-foot-candles, the new lighting eliminates the eye fatigue that formerly plagued the production force. Results: production is up 10%, rejects cut an additional 10%.

Previous lighting consisted of incandescent fixtures, suspended 20 ft from the floor for general illumination, and two-tube fluorescents, mounted three ft above the work benches for supplementary lighting. Although the system afforded a 75-foot-candle illumination in the immediate work areas, it left the rest of the room in comparative darkness. The sharp contrast resulted in eye shock each time an operator looked away from the work table, into the dimly lit areas, and then back to the bright work area.

These repeated shocks built up eye fatigue that became critical in the late afternoon. In the morning and early afternoon, production and morale were good. But about 3:00 P.M. the workers became irritable, bickered over trifles, and became careless. An experienced methods engineer traced the difficulties to faulty illumination.

The new lighting comprises continuous rows of fluorescent fixtures, mounted 10 ft above the floor and spaced on three to four-ft centers. Shadow has been almost entirely eliminated. With the benches cleared of supplementary lights, operators no longer have to reach around such obstacles, and can do their work more easily.



Conveyors Key to Smoother Production in Toy Factory

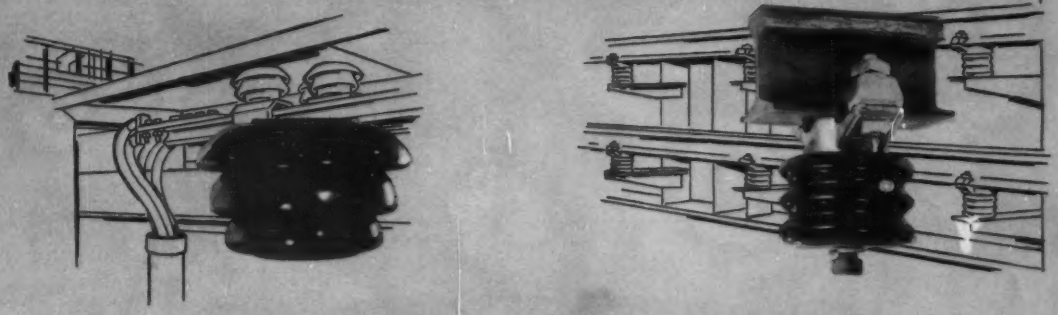
Smoother, faster production and smaller space requirements are two of the principal benefits of a new conveyor belt installed at Colorforms, a Norwood, N. J., manufacturer of educational games for children. Used in conjunction with an infra-red oven, it has cut drying time for silk-screened products and eliminated the air-drying racks formerly used.

Another gain is reduction in in-process inventory. The ½-hp conveyor motor has a variable control to provide belt speeds of 8 to 48 ft per minute and operates from a 220-v, 3-phase line. Two other conveyors are used on the assembly lines to improve flow of work and increase efficiency.

STRENGTH

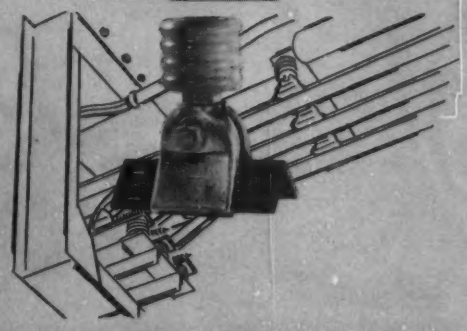
Which kind of strength do you need in insulators for traveling-contact equipment?

MAXIMUM ELECTRICAL STRENGTH



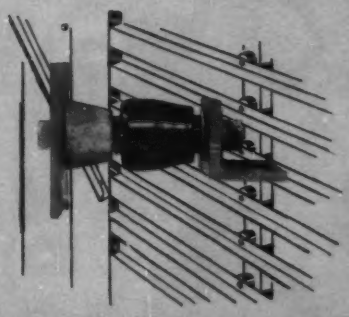
Wet-process porcelain insulators, such as these, offer outstanding electrical properties for high-voltage contact-rail insulation. Especially recommended where dirt, moisture, and other contaminants prevail.
Also available are dry-process porcelain units for power circuits.

MAXIMUM IMPACT STRENGTH



Molded polyester-fiberglass insulators and fabric-reinforced insulators of this general type have exceptional impact strength and vibration-resistance combined with good electrical properties. Tailored to resist chemicals, thermal shock, weathering.

MAXIMUM TENSILE STRENGTH



Molded Giant Strain insulators, adaptable to miniaturization where space is restricted, offer unusual mechanical strength. A very economical insulator having diverse applications.

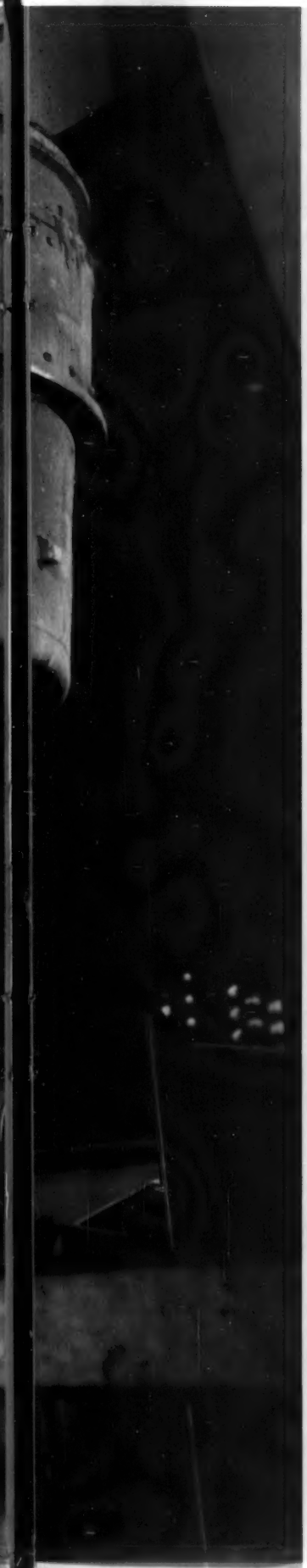
TO HELP YOU DECIDE . . .

. . . on the right combination of properties to meet your insulator needs, Delta-Star engineers from coast to coast invite your problems. Phone the nearest Delta-Star district office or write to Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc., 17th & Cambria Sts., Philadelphia 32, Pa.

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Porter Divisions: Cleveland, Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.



Vacuum casting of ingots...

a new technology in production of USS Quality Forgings for turbine and generator shafting

76-ton ingot cast to produce a generator rotor forging for Large Steam Turbine-Generator Department, General Electric Company.

THE HIGHEST ART OF STEELMAKING is probably exemplified in forged alloy steel turbine and generator rotors for electric power generating equipment. Many of these rotors operate at high temperatures under heavy loads and are, therefore, subjected to the most rigorous inspection through each step of the manufacturing cycle.

Entrapped gases, especially hydrogen, have been suspected of contributing to undesirable internal discontinuities in these large forgings. There is also evidence that hydrogen is associated with low ductility. Several years of experimenting in our melt shops indicated that relatively low hydrogen levels were possible but not low enough to solve the problem completely. The next step was to provide equipment for casting these gigantic ingots in a vacuum, thus removing the gases at the time of pour.

Tests on our vacuum cast forgings produced to date indicate a hydrogen reduction of more than 80% compared with previous air cast methods. Our casting chamber, where atmospheric pressure is reduced 99.9%, is designed to contain an ingot as large as 95" in diameter, weighing about 350,000 pounds. The equipment in which these large ingots are cast was specially designed by United States Steel.

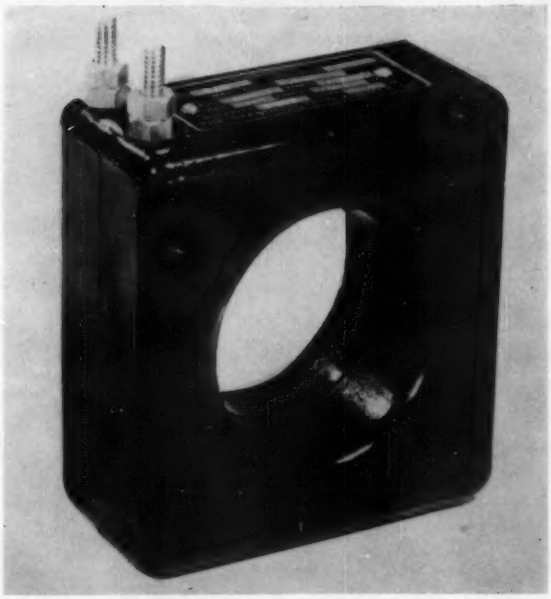
This is but one of the many advances in steel technology constantly emerging from the research laboratories and mills of United States Steel.

We are eager to receive your inquiries. Please address them to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS QUALITY FORGINGS

heavy machinery parts . . . carbon, alloy, stainless
forged steel rolls and back-up roll sleeves
electrical and water wheel shafts
specialty forgings of all types

UNITED STATES STEEL



Molded Current Transformer

. . . for use with ammeters and wattmeters in industrial applications is designed to fit in limited spaces. The epoxy-resin transformers can be switchboard or cabinet mounted, indoor or outdoor.

Cable carrying load current is passed through opening in transformer, and constitutes the primary winding. The transformer is inserted on the load cable. Leads are carried from terminals of winding to meter. Multiple ratios can be obtained by adding turns in the window and adding or subtracting turns in the secondary.

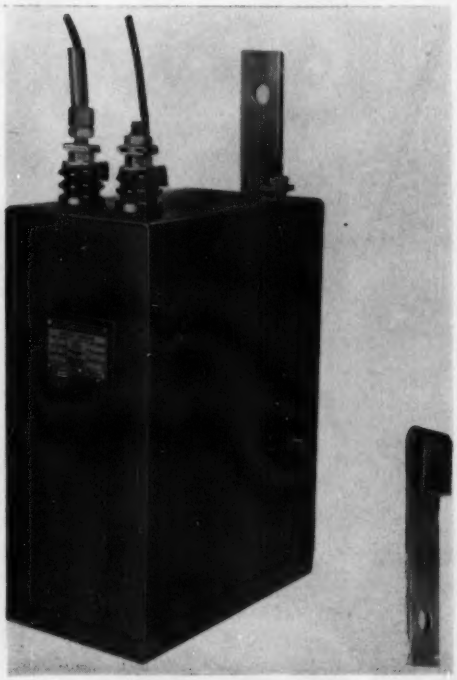
The transformers, designated CGM, come in ratings from 100 to 800 amp primary; 5 amp secondary; 25/400 cycles. Impulse level is 10 kv. Insulation class is 600 v. Further details in Bulletin CGM.
Standard Transformer Co, Warren, Ohio

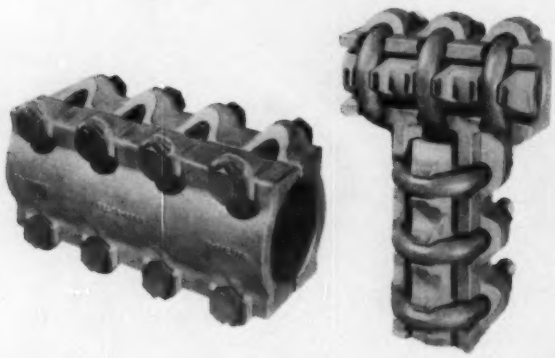
Secondary Capacitor . . .

. . . is an addition to single-phase, 240-v line. Rated 10 kvar, it is known as type FPS. Unit is contained in a rectangular steel case with a zinc-spray finish. A ground stud is welded to the top of the case.

A new set of mounting brackets provides for direct pole mounting with low moment. The bracket uses no hardware. The weight of the capacitor combined with bracket design keeps the unit securely in place on the pole during normal operation, but permits easy removal by linemen.

The capacitor weighs 56 lb. Case, not including terminals, measures 13½x6x10 in. Leads and fusing are consistent with the 3-, 5-, and 7½-kvar models in the same line.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.





Power Connectors . . .

. . . feature positive wrapping and gripping. The aluminum connectors are designed for tubing to tubing, cable to cable, tubing to cable, or terminal lug connections. Designed to carry full rated load of the conductors without heating up more than the conductor itself, they meet applicable NEMA standards. Edges are rounded; bolt-heads recessed.
Delta Star Electric Div, H. K. Porter Co, Inc, 2437 Fulton St, Chicago 12, Ill.

(*More New Equipment on page* 128)

Iowa Power & Light uses neoprene-jacketed cable to overcome galvanic cell action

In June, Iowa Power & Light Co. began installing a 15 Kv underground network to serve the expanding power demands of Des Moines. Cable on the first part of the network was 3-conductor, 500 Mcm paper-insulated, lead-sheathed, neoprene-jacketed. It was pulled into 4-inch black fiber ducts.

Neoprene-jacketed primary cable was selected for most of the installation after Iowa Power & Light asked 34 utilities and cable manufacturers for their experiences with jacket material. A majority favored the use of neoprene.

Among the problems to be overcome was a galvanic cell environment. Since Des Moines discontinued its streetcar system, the power company no longer benefited from a drainage system in which cable sheaths were connected to drain wires. Neoprene jacketing now prevents corrosion of the lead sheath.

This installation is another example of the accepted reliability and long life of neoprene. Of all resilient materials, only rugged neoprene has balanced resistance to sunlight and weathering, oils and chemicals, heat, flex cracking, abrasion and cutting, oxidation and aging.

Ask your supplier about wire and cable jacketed with neoprene. It's available in single and multiple conductor types and voltage ratings to meet your requirements. Mail the coupon below to get the ELASTOMERS NOTEBOOK with actual on-the-job reports of neoprene's performance in a wide range of industrial products.

DU PONT

Better things for better living
. . . *through chemistry*

NEOPRENE

— made by Du Pont for 25 years

E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Dept. EW-11
Wilmington 98, Delaware

Please put my name on the mailing list for the Elastomers Notebook.

Name_____
Position_____
Firm_____
Address_____
City, State_____

MAIL THIS COUPON NOW . . . WHILE YOU'RE THINKING ABOUT IT

"Red Tape"

Westinghouse
KILOWATT HOURS
TYPE DS
15 AMPS
SINGLE PHASE
Westinghouse
INTERVAL
RECORDER NUMBER

saves you money

Exactly! It's magnetic recording tape in the new Westinghouse Load Survey Meter

The new Westinghouse Load Survey Meter uses the principle of automation. It gets the same results . . . higher production from fewer man-hours.

Essentially, the meter is a tape recorder that translates consumer demand indicated by the watthour meter into "intelligence" on the tape—at the maximum rate of 240 demand impulses per interval. The 600-foot tape runs a full 32 days. The tape then is "played back" through a special translator in conjunction with an IBM 526 Printing Summary Punch. In 35 minutes the translator and card punch can deliver a record for the month on punched and printed IBM cards. No engineers, clerks or card-punch operators are involved.

Compare this operation with current methods which require two interpreters for each six recording charts per day—plus an IBM operator—just to read the record and put it in usable form.

The new Westinghouse Load Survey Meter is a truly practical tool. It saves you money in the process of giving you accurate information on which to plan more efficient generation and distribution systems. Complete details are available from your Westinghouse sales engineer—or from Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh, Pennsylvania. J-40490

"Double unit, allowing customer's billing meter to remain in service (upper meter) while load is recorded by means of lower meter, which contains the contact device."

YOU CAN BE SURE...IF IT'S

Westinghouse

It's NEW!

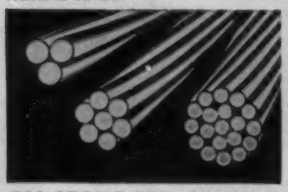
Wire that combines the strength of steel with the high corrosion resistance of aluminum

ACCO *It's Aluminized!*

PAGE STRAND

PAGE has successfully combined two time-tested metals into a revolutionary new wire—ACCO ALUMINIZED—that has a ductile, protective coating of aluminum *bonded* to iron and steel wire by a hot-dip method. This product is covered by and is manufactured under processes covered by U.S. and foreign patents.

Now PAGE offers ACCO ALUMINIZED Steel Strand for guy wire, ground wire and messenger wire applications. Can be used with Preformed Guy-Grip dead-ends made of ACCO ALUMINIZED Wire, or with galvanized pole hardware. Here is evidence of ACCO ALUMINIZED Steel Strand's superiority: salt spray tests conducted in strict accordance with ASTM procedures show that, for equal thickness of coating, aluminized *outlasts galvanized by more than 2 to 1.*

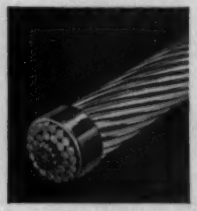


ALL STANDARD GRADES

PAGE ACCO ALUMINIZED Steel Strand is available in Common, Siemans-Martin, High Strength, Extra High Strength and Utility grades with physical properties meeting ASTM Spec. A-122-54-T and A-363-55-T.

NOTE: We will continue to make and market PAGE Stainless Steel Strand and PAGE Galvanized Strand, as heretofore, in 3-, 7- and 19-wire construction.

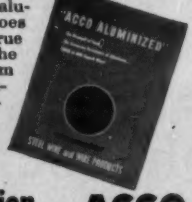
Also... PAGE *Aluminized* ACSR CORE WIRE



Aluminum Conductor Cable with PAGE ACCO ALUMINIZED ACSR Core Wire is now available from many manufacturers of conductor cable. Product quality control is assured by a special testing procedure mutually developed by PAGE and ALCOA.

Send for Informative Booklet

How about ductility and adherence properties of aluminized wire? Why does aluminizing create a true duplex coating over the core? How does aluminum "sacrifice itself" to provide electrochemical protection? For answers, write us at Monessen, Pa., asking for Booklet DH537-A.



ACCO for Better Values

Page Steel and Wire Division

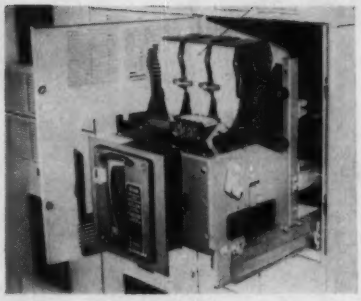
AMERICAN CHAIN & CABLE

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

ACCO

A·C·C

TRADE MARK

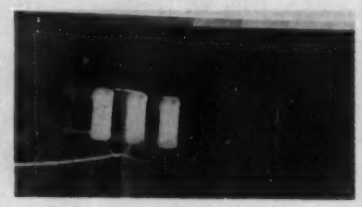


Power Breakers . . .

. . . have quick-make manual closure of breaker contacts. New K line of trip-free circuit breakers—600-v units in 225-, 600-, and 1,600-amp frame sizes—also features motor-driven stored-energy system for electric closure, interchangeable overload trips, accessible parts.

Spring action is strong enough to close contacts against full short, eliminating damaging arcing that results from slow hand closure.

I-T-E Circuit Breaker Co, Switchgear Div, Philadelphia, Pa.



Far Infrared Camera . . .

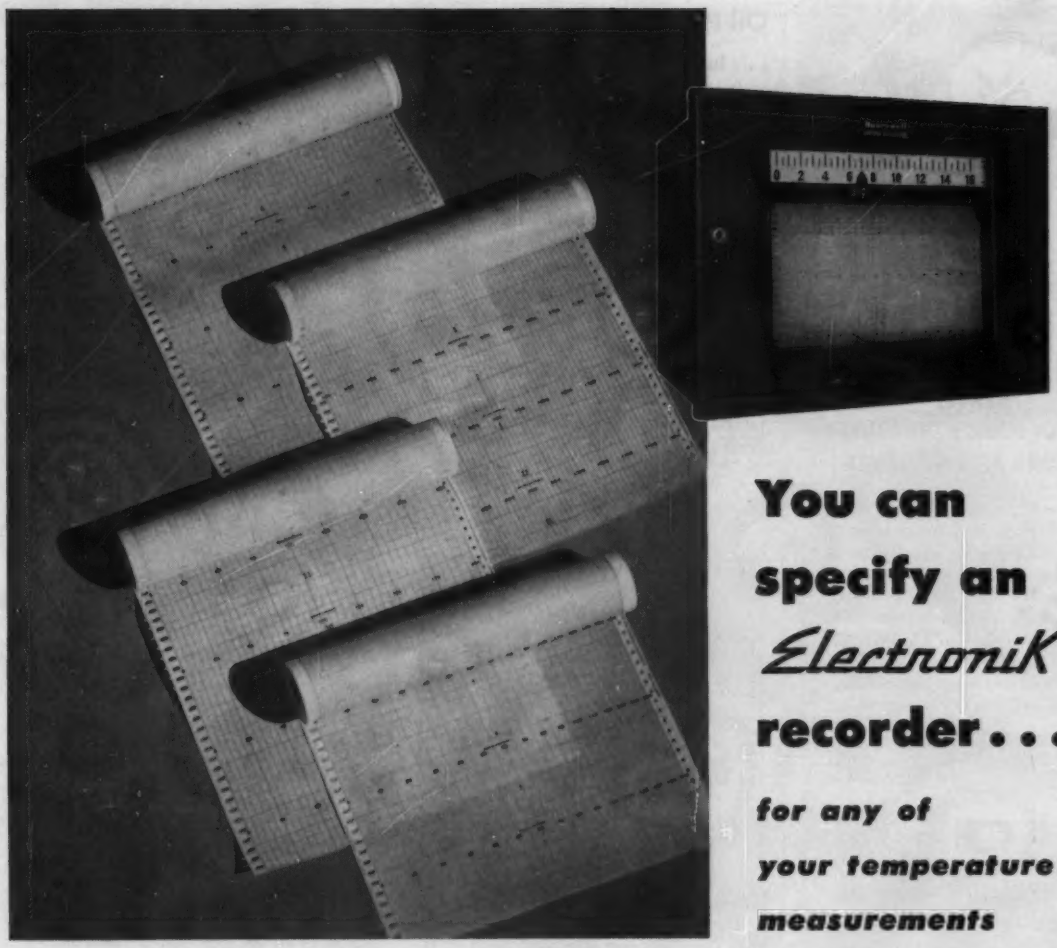
. . . shows temperature distribution of objects photographed. Shade of picture indicates temperature value, hot spots appearing lighter than cool portions. Temperature differences of 0.02C can be measured. Camera assembly weighs about 100 lb.

Wide applications include scanning electrical and industrial equipment and processes. In heat-photo above, transformers and service drop are hot due to heat generated by flow of large current. Wires not carrying current appear cool. Temperature reference scale is at top.

Infrared pictures show also temperature of switches and even structures as large as power plants.

Barnes Engineering Co, Stamford, Conn.

(*More New Equipment on page* 130)



You can specify an *ElectroniK* recorder . . .

for any of your temperature measurements

LET *ElectroniK* recorders keep constant watch over your plant temperatures—accurately, efficiently.

Choose one *ElectroniK* instrument to record a single temperature, or another to combine as many as twenty temperature records on a single chart. When several temperatures are combined on one chart, correlation is simple . . . operators can keep close check on trends . . . engineers can analyze operation in accurate detail.

Built-in circuits adapt these recorders for signalling excess temperatures. And there's a complete Honeywell line of thermocouples, extension wires, and power-plant-type resistance thermometers to work with *ElectroniK* instruments.

ElectroniK instruments are famous for their stamina and dependability. For a discussion of how they can be applied to measuring your plant temperatures, call your local Honeywell field engineer. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR Co., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

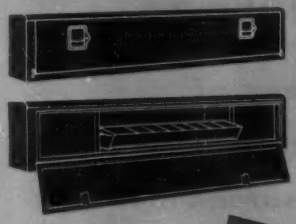
● **REFERENCE DATA:** Write for Bulletin 9070, "Instruments for Electrical Power Generation"

Honeywell

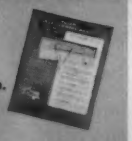
First in Controls

Now...
YOU CAN DOUBLE THE UTILITY OF YOUR PICK-UP TRUCK

Holan utility compartments save tool-searching time, protect tools, discourage pilfering, increase carrying capacity . . . and they are easily installed in a few hours. Holan utility compartments are available in 3 sizes—72″, 84″ and 105″ long. All are made of high-tensile steel and have Holan flush-type handles.



Write for complete utility compartment data.



J. H. HOLAN CORPORATION
4100 WEST 150TH STREET
CLEVELAND 11, OHIO
OTHER PLANTS: GRIFFIN, GA.; PHOENIX ARIZONA; BRANTFORD, ONTARIO

To: J. H. Holan Corporation
4100 West 150th Street
Cleveland 11, Ohio

Please send me complete data about:
☐ Holan Utility Compartments
☐ Holan Service Bodies

Name_____ Title_____
Company_____
Address_____
City_____ Zone_____ State_____

Oil Preservation System . . .

. . . **has rubber air cell** in expansion reservoir to prevent bubbles in transformer oil. As oil expands, cell is deflated and air expelled through weather-tight breather. As oil contracts, atmospheric pressure reinflates the cell. Air does not contact oil.

"Atmoseal" system is available on all power transformers (units above 10,000 kva). Oil pressure can vary only about 0.6 psi throughout operating cycle with oil-temperature change of 120C.

General Electric Co, Schenectady 5, N. Y.

Secondary Capacitors . . .

. . . **for installation at meter box** correct pf near the load. To be designated "Secovar", they will be available for adjacent or socket mounting early next spring. Ratings will be 1 kvar for the nipple-connected type "N", 1.5 and 2 kvar for socket-mounted type "S". A fuse in each lead protects against line or ground faults. Capacitors connect to line side of meter terminals.

Sangamo Electric Co, Springfield, Ill.

Induction Motor . . .

. . . **runs at synchronous speed** without permanent magnets or d-c excitation. The compact "Syncro-Spede" is suitable for applications requiring constant speed with varying load, such as machine tool,

(*Continued on page* 134)

29 of the 50 largest public utilities use HOLAN® bodies and power equipment

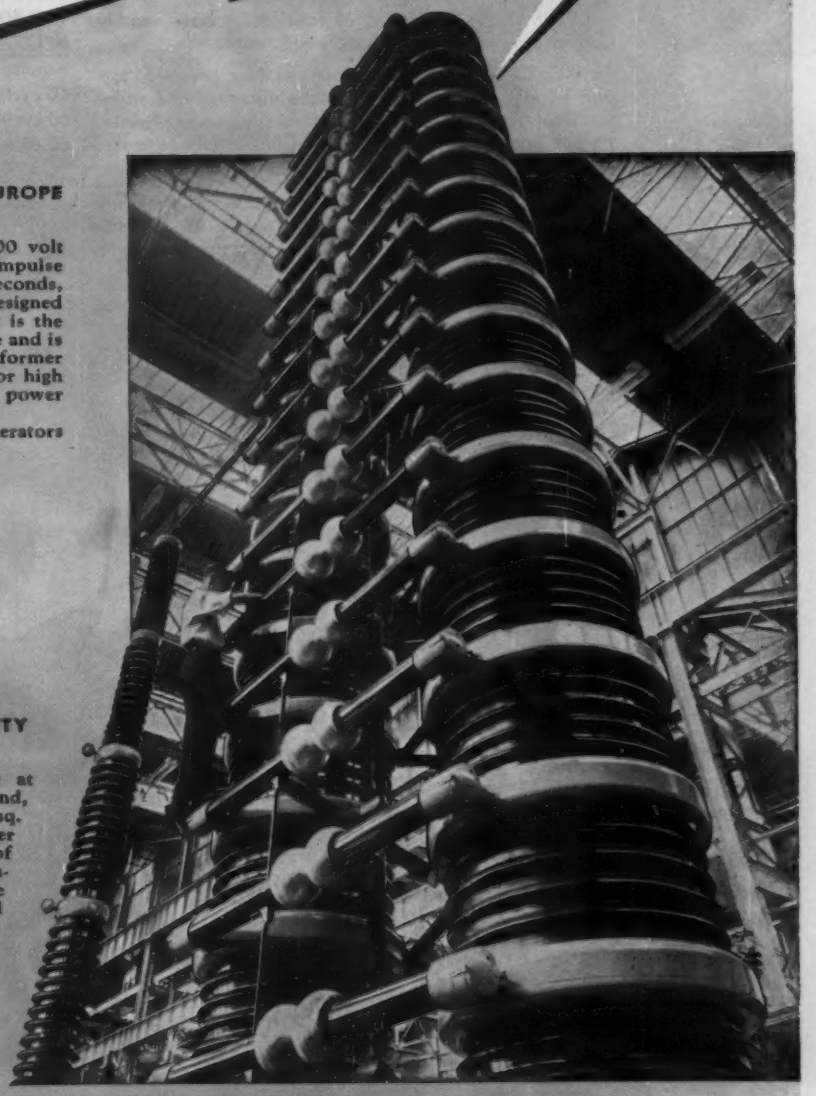
In the third annual edition of the FORTUNE Directory, the 50 largest U. S. public utilities are listed. Most of these companies became big by thinking big—they buy the best equipment in order to obtain the best results. We are proud to note that 29 of these top utilities are Holan customers.

J. Howard Holan

J. HOWARD HOLAN, PRESIDENT
J. H. HOLAN CORPORATION
4100 WEST 150TH STREET
CLEVELAND 11, OHIO

OTHER PLANTS: GRIFFIN, GA.; PHOENIX, ARIZONA; BRANTFORD, ONTARIO

4,000,000 VOLTS!



THE LARGEST
IMPULSE GENERATOR IN EUROPE

The illustration shows a 4,000,000 volt 18 stage, 2 column Ferranti Impulse Generator, energy rating 285 kW seconds, D.C. charging 220 kV per stage. Designed and built by Ferranti engineers, it is the largest impulse generator in Europe and is now installed in the Ferranti Transformer Factory at Hollinwood, England for high voltage impulse testing of large power transformers.
Ferranti High Voltage Impulse Generators are used throughout the world.

F
FERRANTI

OVER 5,000,000 kVA
per annum
of TRANSFORMER CAPACITY

The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C. and D.C. Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.

FERRANTI LTD

Head Office and Plant: **HOLLINWOOD · LANCASHIRE · ENGLAND**

OFFICES AND PLANTS

NEW YORK · Ferranti Electric Inc., 30 Rockefeller Plaza, N.Y. 20
TORONTO: Ferranti Electric Ltd., Mount Dennis, Toronto 15, Ontario
MANCHESTER, ENGLAND: Ferranti Ltd., Moston, Manchester 10
EDINBURGH, SCOTLAND: Ferranti Ltd., Ferry Road, Edinburgh 5

FT 176/2

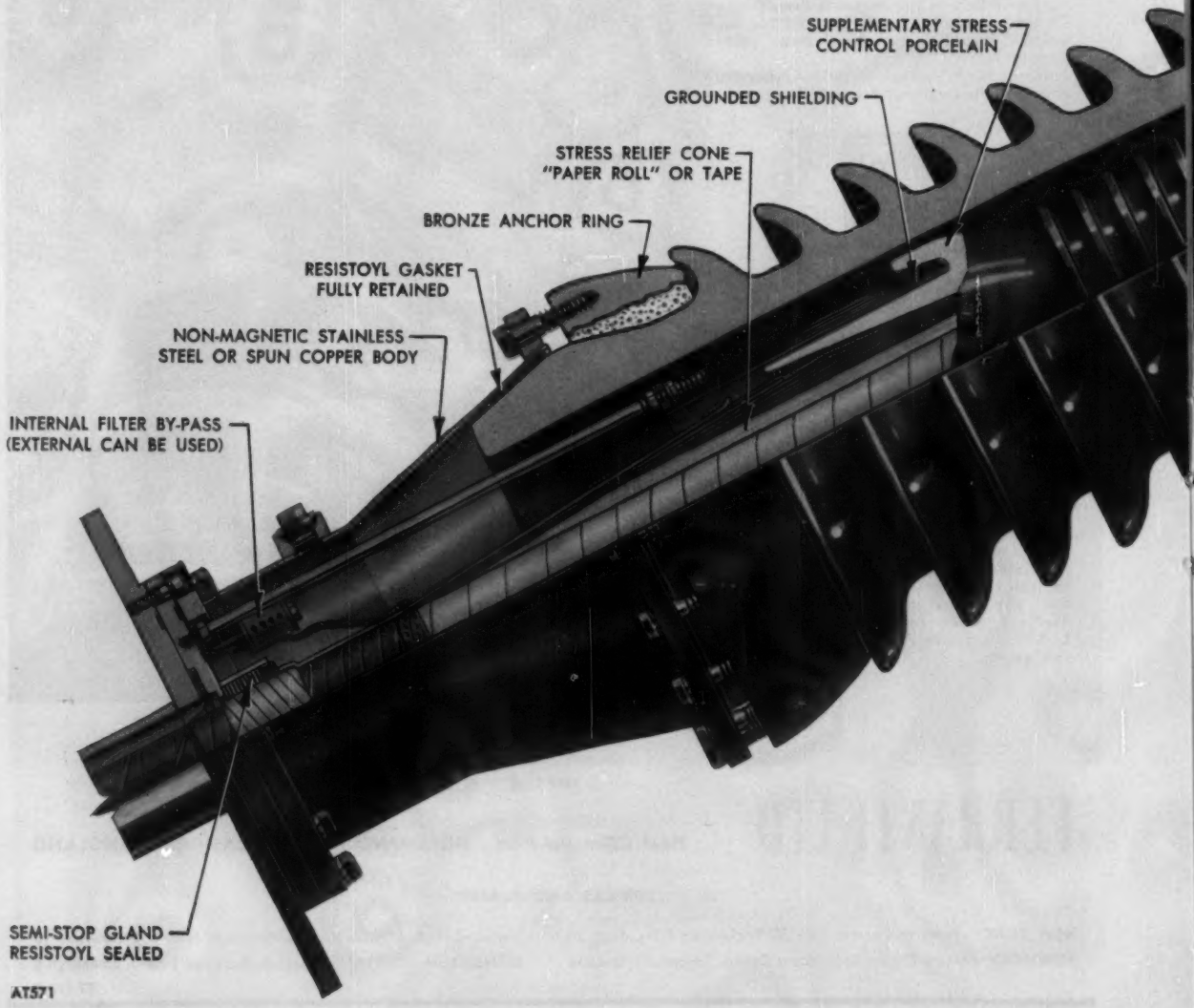
Specify safety, simplicity, ease of installation and maintenance with G&W high voltage (69 to 230kv) cable terminating devices

FEATURES

- SIMPLICITY — A minimum of parts, each designed for maximum function.
- VERSATILITY — Method of fabricating base readily adapts it to varying installation conditions.
- NO CASTINGS — Points withstanding pressure, top and bottom fittings, are fabricated non-magnetic stainless steel and spun copper to eliminate hazardous brittle, porous nature of castings that are susceptible to leaks.
- G&W tests exceed A.I.E.E. withstand tests

230kv pothead terminating 1/C, 500mcm, 230kv, PILC, HPOF cable	A.I.E.E. No. 48	Actual Tests
Impulse, 1.5 x 40ms	1050kv	1232kv
60 cycle, 1 minute dry	545kv	575kv
60 cycle, 10 seconds wet	445kv	545kv
60 cycle, 6 hours dry	315kv	340kv

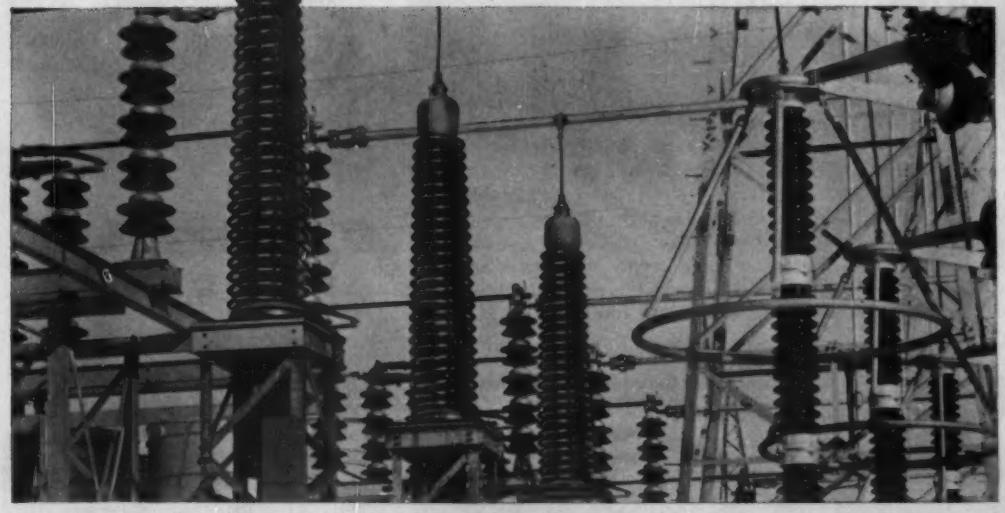
The sound engineering principles of G&W potheads will eliminate the complexities of your cable terminating problems. Their safety, ease of installation and minimum maintenance are essential requirements in which you'll be interested. Notice the features and overall design pioneered by G&W. Specify them with confidence in your plans for high or low pressure oil or gas filled cable systems.


SUPPLEMENTARY STRESS CONTROL PORCELAIN
GROUNDED SHIELDING
STRESS RELIEF CONE "PAPER ROLL" OR TAPE
BRONZE ANCHOR RING
RESISTOYL GASKET FULLY RETAINED
NON-MAGNETIC STAINLESS STEEL OR SPUN COPPER BODY
INTERNAL FILTER BY-PASS (EXTERNAL CAN BE USED)
SEMI-STOP GLAND RESISTOYL SEALED

AT571

STANDARD VOLTAGE RATINGS AVAILABLE
69KV — 92KV — 115KV — 138KV — 161KV — 230KV

The first 230kv pothead installation in the U.S.A. — Garrison Dam, North Dakota. Potheads are installed in switchyard where oil pipe cable is brought from power house transformer deck.



G&W ELECTRIC SPECIALTY COMPANY
3500 W. 127th ST., BLUE ISLAND, ILLINOIS

Facts to file and not forget about BERMICO® electrical conduit

BERMICO
Electrical Conduit
Cellulose and high molecular strength coal tar pitch
MATERIALS
Dielectric strength
Dry ..... 48-52 kv.
Wet ..... 24-36 kv.
Electrical resistance ..... High
Fusibility, if a conductor fails ..... None
Heat resistance ..... High
Cold embrittlement ..... Low
Acid and alkali resistance ..... High
Mechanical strength
(Beam, crushing, impact) ..... Exceeds WC-581
Weight (4" diam.) ..... 2 lbs. per ft.
Abrasiveness to cable insulation ..... Nil

the conduit that gives you maximum, lasting protection with minimum cost!

Engineered to exacting standards, Bermico Conduit provides lightness, strength, and uniformity that makes it easy and fast to install. Made of cellulose fibre, impregnated with high-molecular-strength coal tar pitch with low mineral content. Bermico gives maximum protection against water. In event of cable failure, it permits easy pullout and replacement of conductors.

A hammer tap is all that's needed to make permanent, water-tight joints. Bermico comes in 8′ lengths to speed laying. Diameters are from 2″ to 6″. For economy, protection, long life, always specify Bermico Conduit. Immediate shipment of all sizes and fittings.

Distributed by WESTINGHOUSE Electric Supply Company

Offices in principal cities

BROWN COMPANY

BERLIN, N. H.

General Sales Offices: 150 Causeway Street, Boston 14, Mass.

Induction Motor

(*Continued from page* 130)

paper, and wire drawing. Unaffected by voltage fluctuations, it can also be used for timing and metering devices and recording instruments.

Rated from 1 to 100 hp in any enclosure type, the motor can be foot- or flange-mounted. It is designed for horizontal or vertical mounting.

Louis Allis Co, Dept P, 427 E. Stewart St, Milwaukee 1, Wis.

Transformer Mounting . . .

. . . is redesigned for flexibility in type KO wound-primary outdoor current transformer. Squared-up base is drilled to allow L-brackets to be bolted to base in many positions. This allows vertical, horizontal, and inverted mounting of transformers rated to 800 amp, 5-, 8.7-, and 15-kv.

Allis-Chalmers Mfg Co, Milwaukee 1, Wis.

Generator . . .

. . . starts large motors due to fast voltage regulation. Magnetic-amplifier-type regulator permits a 50-kw, 1,200-rpm generator to start a 15-hp motor at full voltage with 25% dip. The "Amp-Pak" also features a static exciter. Ratings: 50 to 150 kw.

Electric Machinery Mfg Co, Minneapolis 13, Minn.

More New Products

Connectors mount directly through "knock-out" or threaded holes in wiring boxes, panels, and ducts, or on small motors and hand tools. Available with 2, 3, or 4 contacts for 8- to 20-amp applications at a 600-v maximum rating.—Dept. 0-5, Joy Mfg Co, Electrical Products Div, 1201 Macklind Ave, St. Louis 10, Mo.

(*More New Products on page* 138)

AN IDEA PIONEERED BY DUNCAN

Duncan pioneered the Class 200 rating with the "Extended Range" Type MF-SE meter introduced eight years ago. This "50 amp" singlephase meter provided capacity to 200 amps. Within two years, Duncan also made 200 amp "extended range" capacity available in the Type MH polyphase meter.

TYPE MF-SE (1949)

CLASS 200 RATINGS *for More "Housepower!"*

30 AMP.

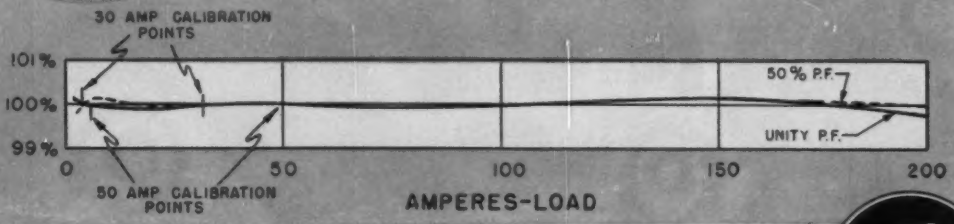
50 AMP.

TYPE MK

The Duncan Type MK Class 200 meter is the latest of the improved singlephase MK line, built to accurately meter a wide range of loads from a few watts to the meter's full 200 ampere capacity. Arc-resistant insulation in the electromagnet, self-contained arc gaps to by-pass electrical disturbances, and Alnico V permanent magnets to maintain calibration stability are just a few of the MK features in this meter.

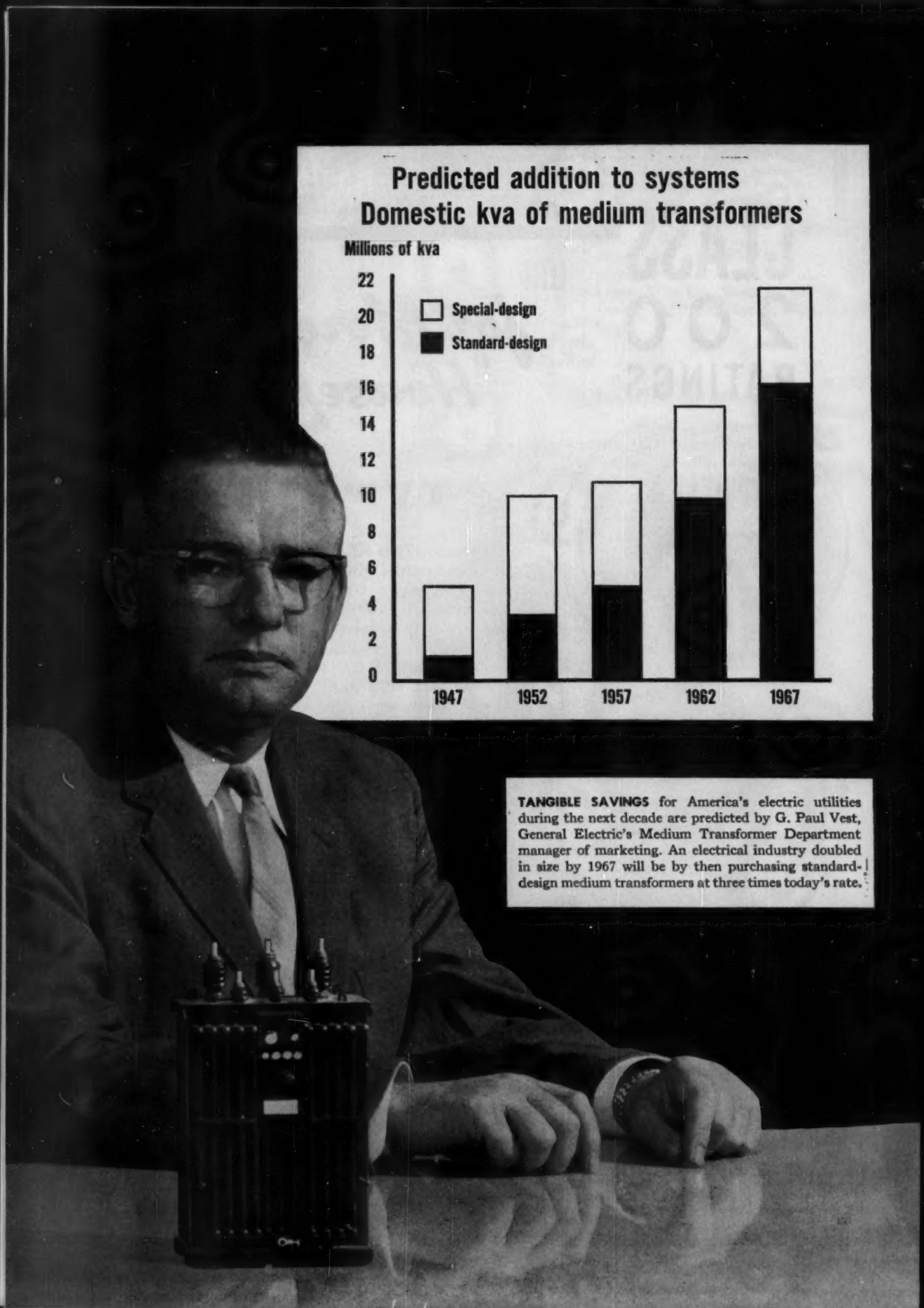
This meter also offers excellent performance. Note the "straight line" load curves in diagram below. Meters are available with test ampere ratings of both 30 and 50 amperes, starting watts 24 and 36, respectively.

Duncan offers "Meters to Meet Your Requirements", with field engineers and representatives serving all areas of the country. Quick delivery from finished stocks. TRY DUNCAN SERVICE!



DUNCAN ELECTRIC CO., INC., LAFAYETTE, INDIANA

LIVE BETTER ELECTRICALLY WITH FULL HOUSEPOWER



TANGIBLE SAVINGS for America's electric utilities during the next decade are predicted by G. Paul Vest, General Electric's Medium Transformer Department manager of marketing. An electrical industry doubled in size by 1967 will be by then purchasing standard-design medium transformers at three times today's rate.

A GENERAL ELECTRIC 10-YEAR FORECAST:

Tripled volume of standard-design transformers to bring savings to utilities

By 1967, an electrical industry doubled in size over the past decade will be purchasing standard-design medium transformers at three times today's rate. The industry will be realizing tangible savings by purchasing standard-design units direct from manufacturers' stock. So forecasts G. Paul Vest, manager of marketing at General Electric's Medium Transformer Department in Rome, Ga.

This prediction is based on continued acceptance of standard-design medium transformers by utilities. For, as acceptance of standard-design units grows, manufacturers can move toward production of "stock" medium transformers. These transformers cost 8 per cent less than specials and will save utilities over $40,000,000 during the next ten years.

Standard-design transformers also will relieve transmission-system engineers of time-consuming details of transformer design and specification.

YOU GET REAL BENEFITS *TODAY!*

But you don't have to wait 10 years to realize the benefits of standardization. You can obtain true economy, now, by specifying General Electric RM (Repetitive Manufacture) transformers. These standard-design units also offer:

Faster shipment—Ten-week shipment is now average for General Electric RM medium transformers. This compares with an industry average of more than 16 weeks for specials.

More and better features—Standard design makes it economically possible for G.E. to offer such extras as Formex* insulated windings, control-center arrangement of instruments and accessories, reversible junction boxes, and many others.

Higher quality for longer life—G-E repetitive manufacture techniques permit 18 assembly-line tests and 22 quality-control inspections during manufacture, to give more dependable operation over a long service life.

G.E.'S BROAD RANGE OF STANDARDS HANDLES 90% OF ALL JOBS

If your company is not yet taking full advantage of the benefits of medium transformer standardization, act today. Ask your G-E Apparatus Sales Engineer to show you how G.E.'s broad range of standard RM medium transformers can meet the large bulk of your needs, and also work efficiently with older, special transformers now on your system. General Electric Co., Schenectady, N. Y.

416-9

*Reg. Trade-mark of General Electric Company.

Progress Is Our Most Important Product

GENERAL ELECTRIC

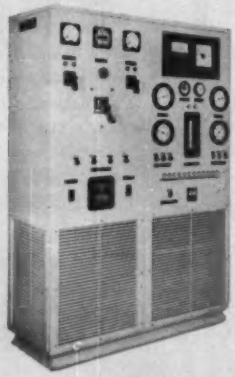
NELSON CONTROLS
govern power for aluminum plant

Nelson furnished 120 Engine Generator Control Boards for the new Port Lavaca, Texas Aluminum Reduction Plant of the Aluminum Company of America.
Nelson customers include 19 of the 30 largest American corporations. Alcoa, as one of these 19, depended on Nelson equipment for reliable, economical, electrical control.
These Alcoa-designed, custom built engine generator control boards provide automatic control of radial diesel engines and D.C. generators which provide the D.C. power for electrolytic reduction of aluminum.

THE FOLLOWING FEATURES ARE PROVIDED IN THESE BOARDS:

GENERATOR SECTION
(Shown at left of photo)

Breaker Control Switches
D.C. Ammeter and Voltmeter
Electric Tachometer
Throttle Control Switch
Field Rheostat Regulation
Automatic Voltage Regulation
Emergency Shutdown



ENGINE SECTION
(shown at right of photo)

Cylinder Temperature Indicator (with alarm)
Oil Temperature and Pressure
Gas Pressure
Water Temperature and Pressure
Scavenger Air Pressure
Automatic Control and Shutdown

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A major source of Electrical Control Equipment for Industry

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

Differential pressure indicator for pneumatic or hydraulic systems measures 0.1 psi difference at 3,000 psi level. An adapter extends range to 100,000 psi.—Kistler Instrument Corp, 15 Webster St, North Tonawanda, N. Y .

Silicone rubber tapes for cable wrapping are not sticky to the touch, but stick to themselves when pressure is applied.—Silicones Div, Union Carbide Corp, 30 East 42nd St, New York 17, N. Y.

Electromagnet features aluminum-foil coils and water cooling. Magnet develops a field, uniform within 5%, of 10,000 gauss at pole spacing of 4 in. Pole gap is adjustable from 0 to 12 in.—Jobbins Electronics, 771 Hamilton Ave, Menlo Park, Cal.

High-pressure **solenoid valve** gives tight shut-off at 1,500 psi in hydraulic-lift and elevator applications. —Automatic Switch Co, Florham Park, N. J.

Carbon-air **cutting machine** is rated 1,200 amp on 100% duty cycle. It is designed for use with carbon electrodes over ½ in. in diameter.—Hobart Bros. Co, Troy, Ohio

Variable-voltage transformers for high-voltage applications are available in two single-unit lines. One gives 10- to 250-kva service for line-voltage compensation. The other is a line of full-range control units rated to 100 kva.—M&T Welding Products Corp, 703 37th Ave, Oakland 1, Cal.

Epoxy molding compound for casting, potting, and laminated parts is a glass-reinforced, mineral-filled material. No mold release agents are needed. Cure times range from 3 to 10 min at 300F.—Booty Resineers Div, American-Marietta Co, Newark, Ohio

X-ray microscope magnifies direct up to 250x on viewing screen, up to 70x on photographic plate. Total useful photo enlargement is 1,500x. Uses include rubber, plastics, and metallurgical industries. — Instruments Div, Philips Electronics, Inc, 750 S. Fulton Ave, Mount Vernon, N. Y.

Are you MISSING something in Electrical World?

You don't want to miss **anything** in the new Electrical World, but, like a small boy at his first circus, **you have to know where to look.** That's where we come in, to play ringmaster. Right now, check the bigger, easier-reading, full-page Table of Contents—first right-hand page. Turn to the Editorial Page which each week will pull together industry thinking on subjects of importance, topping it with a helpful, independent, objective viewpoint. Next you'll hit the high spots of newsworthy industry happenings, covered thoroughly, rapidly, in compact, current-events style. Following this are the week's "lead" articles—full feature treatment of the top news and technical story. And completing the section is the weekly package of technical feature articles you know so well, authored by our 22 full-time editors or by an acknowledged industry authority. For your own information, look over this whole section right now, while you have a minute.

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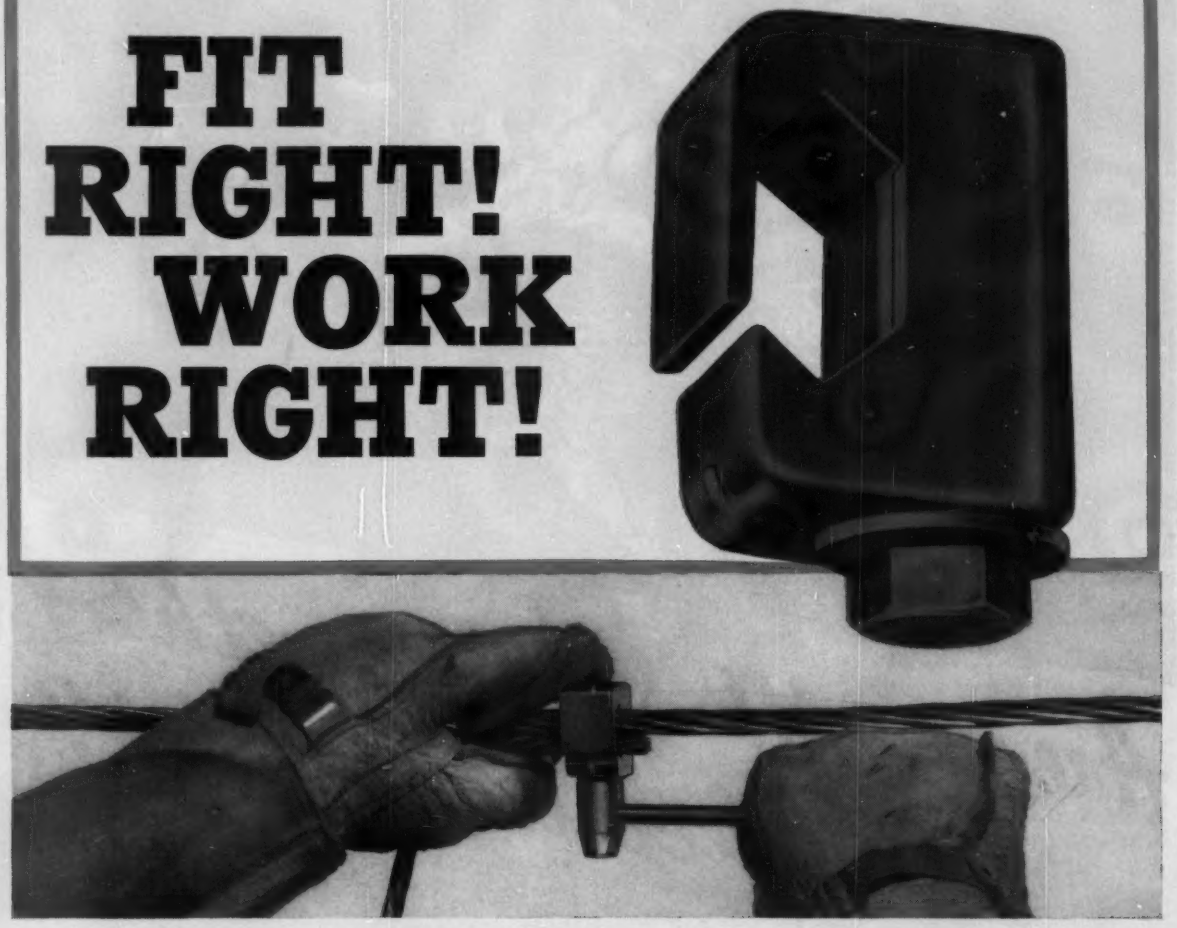

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FARGO "5000" CONNECTORS

Every detail in every Fargo "5000" series connector is right . . . "V" grooves assure perfect conductor alignment . . . greater compressive force . . . conductors completely enclosed . . . high strength . . . vibration proof . . . well rounded corners . . . flat surfaces for back up wrench . . . reusable . . . AND "ONE-PIECE," always threaded, no loose parts.

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FARGO

MANUFACTURERS AND MARKETS

Westinghouse Electric Has Cube-Oriented Steel

A steel which can be magnetized easily in four directions promises electrical apparatus of better performance and simpler construction.

"Double" or "cube-oriented" silicon-iron, for operation with decreased losses at high flux densities has been developed by Westinghouse Electric Corp and scientists of Siemens-Halske, Germany.

Called "Cubex", it has about the same chemical composition as standard 3% silicon steel. Its difference in magnetic properties stems from the way the sheet is handled. Cube-oriented sheets produced in the laboratory are thick enough for use in transformers, motors, and other 60-cps apparatus.

"Cubex" is obtained by reorganizing the metal's crystal arrangement. Atoms of iron naturally arrange to form random cube-shaped crystals. The direction along any cube's edge presents an easy path for flux.

The alignment of "Cubex" crystals may be likened to ice cubes in a tray. Good magnetic paths are along both width and length of the crystals.

Double-oriented steel with 2-mil laminations used only 20 to 33% of the magnetizing force needed for single-oriented steel when dc magnetized. The ac energy requirement is about 67%.

Two American manufacturers now have double-oriented steel.

General Electric Develops Class F Insulation Varnish

General Electric Co has developed industry's first Class F insulating varnish. It is designed to meet high temperature requirements (155C) at low cost.

Class F varnish is expected to cost less than half as much as the Class H varnishes (180C and up), and slightly more than those in Class B (135-155C).

The polyester-type varnish cures at temperatures as low as 125C to a tough, flexible film with good adhesive and electrical properties and resistance to oil, moisture, and acid. It is supplied in a solvent that will not cause excessive swelling in most types of silicone rubber leads.

Typical applications include treating of transformers, magnet coils, stators, field coils, bare copper coils, and other uses under high temperatures where high bonding strength is not a prime consideration.

Dow Corning Shoots Rays at Silicone-Insulated Motor

Gamma rays bombard a running silicone-insulated motor at the rate of 0.1 megarads per hr at Dow Corning Corp's Product Engineering Laboratories.

The 1-hp squirrel-cage motor recently led off a series of tests on electrical insulating systems. The object is to find out how the silicone insulation would stand up under long-term gamma exposure in an atomic power plant.

Dow Corning expects the motor under test to run for ten years.

Shippingport Nuclear Plant Will Get "Kick" from Exide

After 45 years of starting automobiles, Exide batteries will power control circuits on the starter of the Duquesne-Westinghouse power reactor at Shippingport, Pa. They will also apply the brakes to shut it down.

The Shippingport plant will use three 60-cell Exide-Manchex industrial batteries. One starts the drive which moves hafnium rods in and out of the fissionable core, controlling the reaction. Another battery is one of the basic power sources for turbine and generator. Third supplies emergency lighting.

New Cable Testing Unit Installed at Rome Cable

New wire and cable testing equipment at Rome Cable Corp, Rome, N. Y., will increase the company's daily testing capacity as well as reduce its material handling requirements and labor costs.

Products ranging from 600-v building wire up to 15-kv cable can be tested with the additional facilities. Both ac and dc tests can be made in four test areas.

A 75-kva transformer (ac circuit) has high voltage taps of 6.25, 12.5, 25 and 50-kv with full 75-kva capacity at all taps. The ac voltage is continuously variable and may be changed smoothly from zero up to 50,000 v.

The testing equipment is located away from the actual test area. The power feeders are enclosed in metal ducts near the ceiling.

Chance's "Operation Move"

"Operation Move" got underway in mid-October by A. B. Chance Co as the new 87,400-sq ft assembly

(*Continued on page* 144)

[DATA FROM KW ENGINEERS]

COVERINGS AND SHEATHS FOR INSULATED WIRES AND CABLES

Dr. E. G. Sturdevant
Technical Director
Electrical Conductor Division

The term "coverage," as applied to insulated electrical wires and cables, refers to a relatively continuous homogeneous layer or layers of impervious and inert material, applied over an insulated conductor or conductor assembly for the purpose of protecting such conductors from moisture, chemical attack and mechanical damage.

Coverings may be colored, ridged or embossed to indicate circuit identification. Chemical attack refers to damage to the insulation resulting from acids, alkalies and other chemicals in the atmosphere, the ducts or soil in which the cables may be installed. Mechanical damage may result from the abrading, compressing, cutting and tearing forces to which the insulation may be subjected during installation and service.

Coverings may be made of metallic or non-metallic materials. Metallic coverings may be, (1) a continuous metal tube over the insulated conductor, usually made of lead and known as a lead sheath, (2) metal tapes applied spirally about the insulated conductor and referred to as an armor or a shield, depending on the purpose for which it is used, or, (3) metal wires applied spirally either in one direction or in the form of a braid, and again known as an armor or a shield.

Armor is a covering applied primarily for mechanical protection or to add strength for safety purposes while a shield is applied to protect the insulation from electrical stresses and prevent interference in communication conductors. Nonmetallic coverings may consist of, (1) a continuous layer of vulcanized rubber or rubber-like material, generally neoprene, or a thermo-plastic material, called a jacket, (2) spirally applied, moisture-resistant fibrous yarn, usually cotton, glass yarn, or jute, (3) moisture-resistant fibrous tapes, or, (4) moisture-resistant fibrous braids. Combinations of two or more of these may be used as explained later.

The kind and number of coverings used is determined largely by the size of the conductor or cable, the type of insulation on the conductor and the installation conditions. The following is a brief outline of the types of coverings required for the more important types of insulations and installation conditions.

Installation in Dry Conduits and Ducts

Single-conductor rubber and varnished-cambric insulated cables require a covering over the insulation consisting of a moisture-resistant cotton braid on the small sizes and a double braid or tape and braid on the large sizes for protection against mechanical damage. On 600 volt cables for installation in buildings this covering must be flame-resistant, and is usually colored for circuit identification. A neoprene jacket may replace such fibrous coverings on rubber-insulated cables. Paper-insulated cables require a lead sheath for retention of the impregnant, exclusion of moisture, and for mechanical protection. Single-conductor polyvinyl chloride insulated cables usually require no coverings since they are generally considered resistant to flame, water, chemical and mechanical damage.

Multiple-conductor cables which consist of two or more single conductors assembled as a unit are protected by an outer covering. The individual conductors of multiple-conductor rubber insulated cables are generally protected by a single fibrous covering. The outer covering of multiple-conductor cables usually consists of a tape and moisture-resistant cotton braid on rubber and varnished-cambric insulated cables. A neoprene jacket may replace the outer braid on rubber-insulated cables. A polyvinyl chloride jacket is generally used on, but not restricted to, polyvinyl chloride insulated multiple-conductor cables. Multiple-conductor paper-insulated cables have a lead sheath over the assembled insulated conductors.

Installation in Wet Conduits and Ducts

The coverings described for use in dry locations on both single- and multiple-conductor cables are suitable for use in wet locations, except that a lead sheath is required over

varnished cambric, paper and non-moisture-resistant rubber and polyvinyl chloride insulations. Where possibility of chemical attack on lead sheath cable exists, cable is provided with neoprene or polyvinyl chloride jacket over lead sheath.

Moisture-resistant rubber insulation requires mechanical protection in the form of a fibrous covering or coverings or a neoprene jacket. A neoprene jacket is preferred because of its greater resistance to deterioration in wet locations. Moisture-resistant polyvinyl chloride may be used without a covering on single-conductor cables.

Aerial Installations

The types of coverings described for use in wet locations are generally suitable for aerial installations but greater thicknesses of non-metallic coverings, particularly for single-conductor cables, are required. Fibrous coverings for aerial use are usually made of moisture-resistant jute, sisal or loom-woven cotton of large size. Neoprene jackets on single-conductor cables for aerial installations are greater in thickness than those used for duct installations.

These thicker covers provide the additional mechanical protection required for aerial installations. Neoprene jackets are generally preferred over fibrous or rubber jackets because of their greater resistance to weathering. Lead sheathed cables with the same sheath thickness as used for duct installations are suitable for aerial installations. A lead alloy containing small amounts of antimony or tin is used instead of pure lead to reduce failures due to crystallization.

Direct Burial

For direct-burial installations, rubber, rubber-like or thermoplastic jackets or lead sheaths are generally used. The jacket or sheath thicknesses are the same as those used for aerial installations. Lead sheaths require protection against mechanical damage. This usually consists of two servings of moisture-resistant jute yarn immediately over the lead, followed by two steel tapes over which are applied two servings of moisture-resistant jute.

Submarine and Vertical Cables

Submarine cables require protection against mechanical damage and need additional strength over that provided by the conductors to prevent them from being broken by dragging anchors or other objects. Vertical cables frequently require greater strength for their support than that provided by the conductors. This additional strength and mechanical protection is usually provided by a serving of steel wires which completely covers the surface of the cable. This is known as a wire armor. A bedding consisting of two moisture-resistant jute servings is provided between the non-metallic jacket or lead sheath and the armor wires.

Portable Installations

Cables for portable installations such as those used on dredges, shovels and mining equipment must be flexible and their sheaths must be resistant to abrasion, cutting and tearing. Tough wear- and weather-resistant rubber or rubber-like jackets are therefore used. Such jackets are generally made in two layers with a reinforcing braid of high-strength cotton, rayon or glass yarn between them. The jacket thicknesses for such cables are generally greater for a given size of cable than those of cables for non-portable installations.

Shielding

Shields consist of one or more conducting layers on insulated electric power cable the purpose of which is to confine the dielectric field to the insulation on the individual conductors. The three most important functions of shields are, (1) to protect the insulation against harmful electrical stresses and discharges at its surfaces, (2) prevent induced voltage in a conductor from outside sources, and (3) to reduce hazards of shock.

Harmful electrical stresses can occur at both the internal and external surfaces of an insulation, particularly on stranded conductors. At high voltages, it is necessary to provide shields at both surfaces. Internal shielding in the form of a semi-conducting fibrous material is generally used immediately over the conductor for operating voltages above 2000. External shielding usually consists of a semi-conducting fibrous layer immediately over the insulation over which is applied a layer of metallic material. External shields are generally used at voltages above 3000 for non-metallic jacket cables and above 10,000 for lead-sheathed cables.

Metallic shields are made of non-magnetic materials such as aluminum or copper and are applied as tapes on cables for non-portable installations and as braids for portable cables. External shields must be grounded at all joints and terminals.

A KW representative or a KW distributor will be glad to give you immediate attention. Call your Kaiser Aluminum sales office. Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Bldg., Oakland 12, Calif.; *General Sales Office*, Palmolive Bldg., Chicago 11, Ill.

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"Operation Move"

(*Continued from page* 141)

building is being completed in Centralia, Mo. First department to move into the building was the Switch Assembly from the St. Louis plant. Transfer of the cutout assembly, fuse link assembly, and other St. Louis facilities is expected to be completed by mid-November.

Kaiser Rounds the Edges On Flat Aluminum Wire

Round-edge flattened aluminum wire is being milled by Kaiser Aluminum & Chemical Sales, Inc, at their Newark, Ohio, plant.

Thicknesses range from 0.020 to 0.187 in.; widths, from 0.063 to 1.000 in. The wire is available in EC grade and in alloys 1100, 3003, 5052, and 5056.

Applications include transformer windings, current-limiting reactors, commutator windings for d-c generators, and armor for electromagnets and cable.

Fabri-Seal Insulation Fails But Reputation Unharmed

Elliott Co, maker of Fabri-Seal insulation for its large induction motors, had some explaining to do when the insulation experienced its first failure since its introduction in 1948. A motor, serving a Gulf Coast chemical plant, failed in an atmosphere of corrosive hygroscopic magnesium chloride dust.

At first Elliott Co engineers could not believe Fabri-Seal had failed, after 8 years with a perfect record. But investigation showed "faulty materials and workmanship." They were consoled, however, by the customer's admission that the atmosphere was "the world's most severe insulation application." Elliott Co repaired the motor, and returned it to service.

U. S. Aluminum Production

Primary aluminum production in the United States, reported by the Aluminum Association, New York,

(*Continued on page* 146)

Electro-Motive Honored for Diesel Work

The Sperry Award, for contributions to the field of transportation, went this year to a group of the Electro-Motive Div, General Motors Corp for development of the diesel-electric locomotive.

Presenting award (second from left) is Robert B. Lea, chairman of the Board of Award and representative of the American Society of Mechanical Engineers. Recipients are Harold L. Hamilton (left), retired vice president of General Motors and founder of the Electro-Motive Div; Richard M. Dilworth (second from right), retired chief engineer of Electro-Motive Div; and Eugene W. Kettering, director of research, Electro-Motive Div, General Motors Corp.

RELIGHTING PLAN for Hendersonville, N. C.'s Main Street is reviewed in light of results. Left to right are Duke Power Company local manager J. M. Gaines; General Electric illuminating engineer R. M. Swetland; and Mayor A. V. Edwards.

Start-to-finish engineering help is part of General Electric's street lighting "package"

Initial survey, preliminary application investigation, action recommendation, complete Illuminating Engineering Report for your staff or consultants . . . any or all of these services are included in the engineering aid "package" at your disposal when you place your street lighting business with General Electric!

General Electric has experienced outdoor lighting specialists in all key cities. Backing up these field specialists are more career lighting men at the Hendersonville, N. C., plant. The talents of both groups are available to you at all times.

Benefit from the years of street lighting experience General Electric has gained since Thomas Edison lighted the street in front of his home in 1879! Put this accumulated know-how to work devising the best means to bring greater visibility to your city's streets!

VISION-ENGINEERED SYSTEMS

Let G. E. help your street lighting program on a *vision-engineered system* basis. On every lighting project, regardless of size or type, General Electric offers, in addition to engineering aid:

PROJECT RESPONSIBILITY—one source of supply for *all* your street lighting needs. This includes full lines of filament, mercury, and fluorescent luminaires, and a complete selection of control and auxiliary equipment.

RESEARCH LEADERSHIP—the industry's newest and most complete laboratory, development, and proving facilities are located at G. E.'s "Outdoor Lighting Center of the World" in Hendersonville, North Carolina.

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Don't let terminating or splicing problems hold up needed cable installations! You can find correctly designed answers to them, fast, from PLM — whether your requirements call for standard or special items.
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PLM
Terminators
Splicing Kits
Conduit Ventilators

Aluminum Production

(*Continued from page* 144)

for the year through September totalled 1,239,010 tons. This amount is slightly higher than the 1,236,650 tons for the corresponding 1956 period. However, the production for September was 129,277 tons, compared to 143,448 tons for August, and 132,316 tons for September, 1956.

M & M BRIEFS

RT&E Corp, Waukesha, Wis., has developed a full line of completely self-protected distribution transformers in ratings 5 through 100 kva. The units consists only of the "plus" ratings. The new line is now in production and a stock of units will be maintained.

Multi-Amp Corp, Union, N. J., has a test set of two units, each weighing less than 10 lb, for on-location or shop testing of underground network system protectors and also relays.

Utica Wire Corp of Derby, Conn., has joined the Viclad Industries, Inc, family as its newest subsidiary. The Utica drawing mill makes electrical-conductor-grade copper wire, electrolytically refined and drawn from scalped bar. Monthly capacity is 100,000 lb.

Brush Electronics Co, Cleveland, Ohio, has a frequency spectrum analyzer which can be used to measure components of transformer noise in one-third octave steps, presenting data in chart form. The analyzer has been used on tests of a 2,000-kva gas-filled transformer at General Electric Co's, Pittsfield sound laboratory.

Babcock & Wilcox Co shipped 450 tons of boiler parts to the Toyko Electric Power Co, Japan. A similar shipment scheduled for December will raise the total to 1150 tons—the largest movement of locally produced equipment ever made from the port of Wilmington, N. C.

"Our greatest challenge . . . the development of men"

Ralph Cordiner, President, General Electric Company

"Few expenditures we can make are more important than those for education. A well-educated person produces more and consumes more, makes wiser decisions at the polls, mounts a stronger defense against aggression, and is better able to perform the grave responsibilities of American citizenship.

"Freedom needs educated people. So do business and industry. I earnestly ask you to support the college or university of your choice in its planning for expansion and a stronger faculty. The returns will be greater than you think."

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MEETINGS CALENDAR

DECEMBER

American Society of Mechanical Engineers—Annual Meeting, Statler Hotel, New York City, Dec. 1-6.

Edison Electric Institute — Accounting Division Electronics Seminar, sponsored jointly with AGA, Sheraton Cadillac Hotel, Detroit, Mich., Dec. 2-4; Electric Space Heating and Air Conditioning Committee, Cincinnati, Ohio, Dec. 4-6; Industrial Relations Committee, sponsored jointly with New England Personnel Group, Sheraton Plaza Hotel, Boston, Mass., Dec. 5-6; Market Research Committee, Louisville, Ky., Dec. 5-6; Accounting Division Depreciation Committee, sponsored jointly with AGA, Lord Baltimore Hotel, Baltimore, Md., Dec. 9-10; Commercial Cooking & Water Heating Committee, Detroit, Mich., Dec. 12-13; EEI-AGA Customer Activities Group, Accounting Employee Relations Committees, Netherland Hilton Hotel, Cincinnati, Ohio, Dec. 12-13.

American Mining Congress—Annual Membership Meeting, New York, N. Y., Dec. 2.

Interstate Power Club—Hotel Martinique, New York, Dec. 9.

Electric Companies Public Information Program — Steering Committee, Palmer House, Chicago, Ill., Dec. 10.

Electric Companies Advertising Program—Management Group, Palmer House, Chicago, Ill., Dec. 12.

• **Electronic Industries Association**—Conference on Maintainability of Electronic Equipment, University of Southern California, Los Angeles, Calif., Dec. 18-19.

JANUARY—1958

International Home Furnishings Market—Including Appliance Show, The Merchandise Mart, Chicago, Ill., Jan. 6-17.

Edison Electric Institute—Home Service Committee, Chicago, Ill., Jan. 8; 2nd Annual LBE National Womens' Conference, Edgewater Beach Hotel, Chicago, Ill., Jan. 9-11; Industrial Relations Committee, Mayflower Hotel, Washington, D. C., Jan. 16-17; Dealer Coordination Committee, EEI Headquarters, New York City, Jan. 30-31.

Instrument Society of America—Boston Section, Yankee Instrument Fair & Symposium, Hotel Bradford, Boston, Mass., Jan. 14-15.

Industrial Heating Equipment Association — Penn Sheraton Hotel, Pittsburgh, Pa., Jan. 27-28.

American Society of Heating and Air-Conditioning Engineers—64th Annual Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa., Jan. 27-29.

Home Improvement Products Show—Hotel Sherman, Chicago, Ill., Jan. 27-29.

FEBRUARY

National Association of Purchasing Agents—Public Utility Buyers Group Mid-Winter Meeting, Sheraton Hotel, Philadelphia, Pa., Feb. 2-4.

National Rural Electric Cooperative Association—Annual Meeting, Memorial Auditorium, Dallas, Tex., Feb. 2-6.

Edison Electric Institute — Prime Movers Committee, Penn Sheraton Hotel, Pittsburgh, Pa., Feb. 3-5; Industrial Power & Heating Group, Netherland Hilton Hotel, Cincinnati, Ohio, Feb. 6-7; EEI-AGA 1958 Conference Final Planning Meeting, Ben Franklin Hotel, Philadelphia, Pa., Feb. 6-7; Electrical Equipment Committee, Dayton Biltmore Hotel, Dayton, Ohio, Feb. 10-11; Transmission & Distribution Committee, Lord Baltimore Hotel, Baltimore, Md., Feb. 11-12; Meter & Service Committee, Sheraton Hotel, Philadelphia, Pa., Feb. 17-19; Industrial Relations Committee, (joint dinner with AGA Personnel Practices Committee) AMA Mid-Winter Personnel Conference, Feb. 20.

• **Industrial Electrification Council**—National Industrial Heating Conference, Netherlands Hilton Hotel, Cincinnati, Ohio, Feb. 3-6.

American Institute of Electrical Engineers—Winter General Meeting, Statler and Sheraton-McAlpin Hotels, New York City, Feb. 3-7.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 6-7.

NATIONAL ELECTRICAL WEEK WILL BE OBSERVED FEBRUARY 9-15.

American Public Power Association—Engineering & Workshop Meeting, Chattanooga, Tenn., Feb. 13-14.

American Institute of Mining, Metallurgical, and Petroleum Engineers—Annual Meeting, Hotel Statler, New York City, Feb. 16-20.

MARCH

Southern Safety Conference, Inc—Exposition, Peabody Hotel, Memphis, Tenn., March 2-4.

Lighting Lamps and Electrical Manufacturers Salesmen's Association—First National Lighting Exposition, Coliseum, New York City, March 9-12.

Nuclear Congress—Co-sponsored by American Society of Mechanical Engineers and the Engineers Joint Council, International Amphitheater, Chicago, Ill., March 16-22.

National Association of Corrosion Engineers—Annual Conference & Exhibition, Municipal Auditorium, San Francisco, Calif., March 17-21.

American Society of Mechanical Engineers—Management Conference Committee, Hotel Somerset, Boston, Mass., March 19-20.

Edison Electric Institute—Industrial Relations Committee, Headquarters, New York City, March 20; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., March 24-27.

American Power Conference—20th Anniversary Meeting, Sherman Hotel, Chicago, Ill., March 26-28.

Southeastern Electric Exchange—Annual Meeting, Boca Raton Hotel and Club, Boca Raton, Fla., March 31-April 2.

APRIL

• **American Society of Mechanical Engineers**—Conference of Instruments and Regulators, University of Delaware, Newark, Del., April 1-3; Maintenance and Plant Engineering Conference, Penn-Sheraton Hotel, Pittsburgh, Pa., April 14-15.

• **Edison Electric Institute**—EEI-AGA National Conference of Electric and Gas Utility Accountants, Shamrock Hilton Hotel, Houston, Tex., April 14-16; Industrial Relations Committee, EEI Headquarters, New York City, April 17; Accident Prevention Committee, Perry Hotel, Toledo, Ohio, April 27-30.

• **American Welding Society**—Annual Meeting and 6th Welding Show, Statler Hotel, St. Louis, Mo., April 14-18.

• **Missouri Valley Electric Association**—Engineering Conference, President Hotel & Municipal Auditorium, Kansas City Mo., April 16-18.

• Additions this week.

At Muskegon, Michigan...

G-E Boiler Feed Pump Motors Minimize Noise in Consumers Power Company Station

To help meet peak industrial load demands in Western Michigan, Consumers Power Company recently added a fifth generating unit to their B.C. Cobb station in Muskegon. This General Electric-equipped unit utilizes three new, 2500-hp G-E Boiler Feed Pump Motors to give the B.C. Cobb station a 510,000 kilowatt capacity—largest on the Consumers Power System.

According to Mr. E. J. Palmer, plant superintendent, the acoustic treatment of the new motors "certainly makes it easier on the operators." The G-E motors feature a unique, acoustically-treated top section which has all but eliminated uncomfortable, high-speed motor "whine."

Other features of these motors include a new pressure-sealed bearing system and new materials and manufacturing techniques which have added years of life and reduced motor maintenance.

As a result, G-E Boiler Feed Pump Motors provide the quiet, efficient, low-maintenance operation demanded of modern power-station auxiliaries.

Where electricity is generated, electric drives give top performance

...here's why

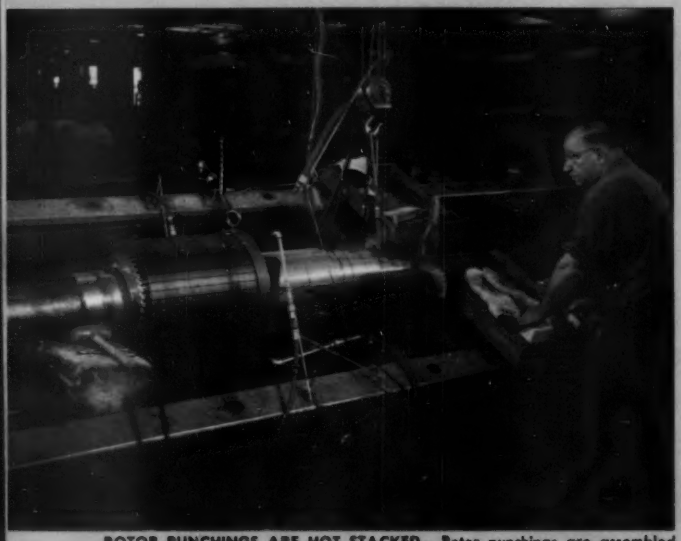
ELECTRIC DRIVES FOR THE ELECTRIC INDUSTRY

Progress Is Our Most Important Product

GENERAL ELECTRIC

ELECTRIC DRIVES FOR THE ELECTRIC INDUSTRY

New rotor manufacturing techniques improve G-E Boiler Feed Pump Motor performance



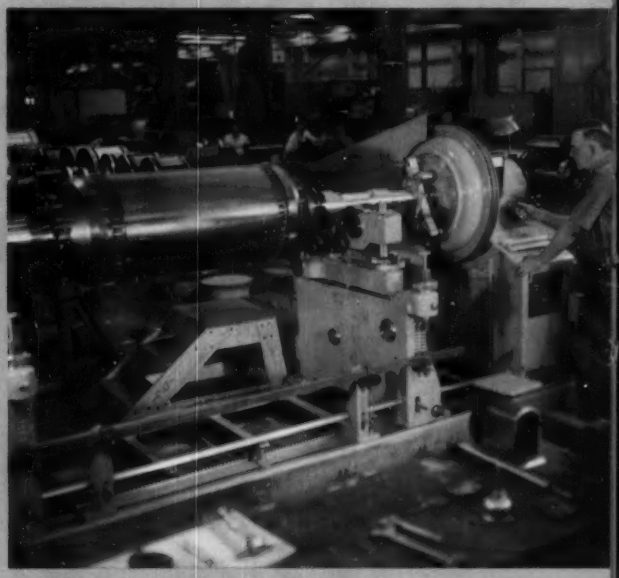
ROTOR PUNCHINGS ARE HOT STACKED—Rotor punchings are assembled in small packages, heated in an oven for several hours, stacked on heavy steel shaft and cooled to room temperature at over 100-tons force. Punchings remain perpendicular to shaft, eliminating "punching migration."

To improve motor efficiency, lower maintenance costs and reduce the noise level, General Electric engineers have developed new manufacturing techniques and better materials for the precision-made rotors of G-E Boiler Feed Pump Motors. Coupled with rigid quality-control tests, these techniques and materials mean significant improvements in rotor performance. For example:

- Precision-machined shaft journals are given a final, high-polish finish to reduce bearing losses and increase bearing life.
- Solid copper end rings, forged from heavier gage stock than used for conventional rotors, provide greater rotor stability. Milled end ring grooves give proper mechanical rotor bar fit.
- Non-magnetic steel retaining rings, supported from the shaft, are fitted over the *entire* end ring assembly to limit stress build-up in end ring and rotor bar connections during motor operation.

Careful attention to every detail of rotor construction is just one more reason why General Electric Boiler Feed Pump Motors operate more reliably, more efficiently and with less attention. For complete information on General Electric's new Boiler Feed Pump Motor, contact your nearest G-E Apparatus Sales Office or write section 882-6, Medium AC Motor and Generator Department, General Electric Company, Schenectady 5, New York.

ROTOR BARS AND END RINGS ARE SILVER-BRAZED—Solid copper bars are driven through stacked punchings and held firmly in place by copper end rings. Bars and end rings are joined by silver brazing to help provide a virtually indestructible rotor with minimum electrical resistance.



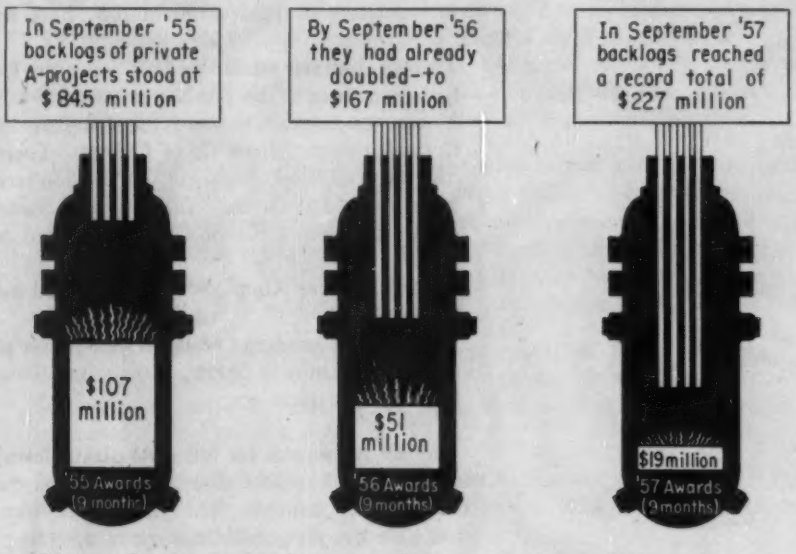
COMPLETED ROTORS ARE DYNAMICALLY BALANCED—Specially designed General Electric machines test each completed rotor for smooth, quiet, vibration-free operation. Machine balance is later verified when rotors are checked again, assembled in their own bearings.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ELECTRICAL BUSINESS OUTLOOK

Electrical World
NOVEMBER 25, 1957


In September '55 backlogs of private A-projects stood at $84.5 million
By September '56 they had already doubled-to $167 million
In September '57 backlogs reached a record total of $227 million
$107 million
'55 Awards (9 months)
$51 million
'56 Awards (9 months)
$19 million
'57 Awards (9 months)

Backlogs of private work go up, but contracts go down as . . .

Atomic Construction Remains Sub-Critical

The U. S. atomic power picture has been clouding rather than clearing. Recently the Atomic Energy Commission cancelled its order to AMF Atomics for a 22-Mw reactor at Elk River, Minn., when costs went up to $11.7 million. Previous estimate was $8.9 million. Consolidated Edison Co of New York's Indian Point plant was quoted at $90 million instead of the original $55 million. Sylvania-Corning Nuclear Corp abandoned plans for a Massachusetts nuclear components plant. Foster-Wheeler Corp broke up its power reactor team after AEC balked at its higher price tag on a project for Wolverine Electric Cooperative Association of Big Rapids, Mich.

Shrinking private construction awards underline the situation. McGraw-Hill's "Construction Daily" reports that during the first nine months of 1955, the year after the atomic industry was opened to private business, $107 million worth of private atomic construction contracts were awarded. During the same period in '56 awards totaled $51 million. Through September of this year private contracts added up to only $19 million.

And the backlog of private atomic projects proposed has built up steadily. In September 1955 it stood at $84.5 million. By 1956 it had risen to $167 million. In September of this year, the backlog was up to a whopping $227 million. "Construction Daily's" figures on backlogs reflect costs estimated at the time of the proposal. Any reevaluation in price would probably raise the backlog of planned work still higher.

These figures emphasize that cheap nuclear power is not developing as rapidly as was generally expected three years ago. The whole spirit of unqualified exuberance with which many manufacturers jumped into the nuclear business in 1955 is showing up as over-optimistic. (*more*)

But behind the construction figures is another significant fact. Practically all the contracts awarded so far in 1957 have been for research.

Two big contracts pushed up 1955's awards. One was let by Consolidated Edison for construction of the 275-Mw pressurized-water reactor station at Indian Point. The other contract covered the Dresden 180-Mw boiling-water reactor for Commonwealth Edison Co of Chicago. Together these two awards add up to over $100 million of the total $107 million recorded during the first nine months of the year; and the only addition after September was for part of a 100-Mw reactor for Detroit Edison Co which tacked on another $4 million.

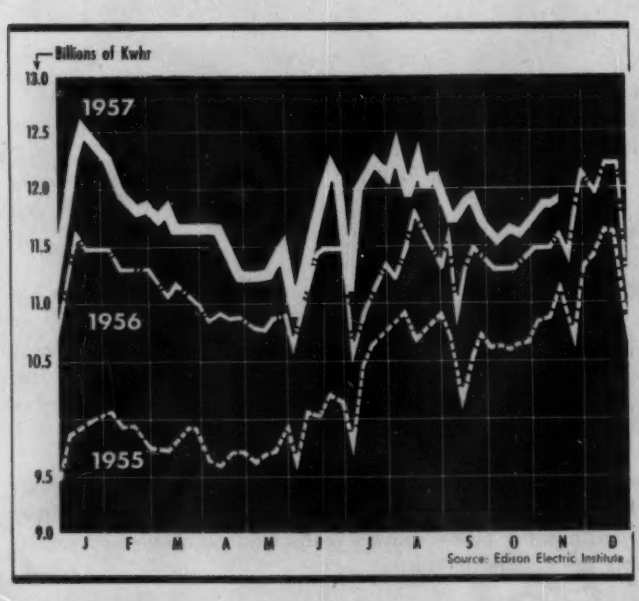
In 1956 Yankee Atomic project accounted for 3/5 of the total private awards.

This year has produced no large-scale power plant contracts. This fact accounts for the difference in figures. This year private contracts awarded for research have actually gone up.

Why are the awards for full-scale plants down? One explanation is that the big companies who could afford to "get in on the ground floor" of atomic power have already done so. The others have been banding together and planning, but have not yet got to the stage of awarding big contracts.

There's more that would excuse a delay in atomic power development. The realization of true costs, the reappraisal of how long it will be before nuclear power can compete economically with conventional fuels, the lack of understanding about what the government plans to do about the situation, would all be sufficient reason to warrant reconsidering plans for nuclear power stations now. In spite of the uncertainty, research is going on, and it is significant to note that none of the proposed plants that are swelling the backlog of private atomic work have been cancelled.

STATISTICS



OUTPUT

Week ended November 16, 11,953,000,000 Kwhr Up 3.1%

Per Cent Change From Previous Year

	Nov. 2	Nov. 9	Nov. 16
Total U. S.	+3.2	+3.4	+3.1
New Eng.	+4.2	+2.6	+2.0
Mid. Atlan.	+1.7	+2.1	+1.3
Cent. Ind.	+2.5	+1.6	+1.8
West Cent.	+5.9	+5.9	+4.9
Southeast	+6.4	+4.0	+4.0
South Cent.	+4.4	+6.8	+6.0
Rocky Mount	−1.1	+2.4	+1.7
Pacific			
NW	−3.5	+3.1	+2.9
SW	+4.5	+6.8	+6.5

Seasonally Adjusted Index 226.1
Week Ago 227.9
Year Ago 218.8

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 4.2%

MANAGEMENT BULLETIN

FINANCE ▶ **The Federal Reserve Board reduced the rediscount rate from 3½% to 3%,** reversing its action of last August. The move came as a complete surprise not just to economists, but to bankers and to some of the Fed officials themselves. Up until Nov. 14, when the announcement was made, everybody had thought the Fed would hold the line. This included the head of the Fed, who indicated recently that there would be no change in the rediscount rate at this time.

After the announcement, the stock and bond markets took a whirl on the upside. Government long-term bonds were up as much as 1⅛ points on Friday (Nov. 15), for the highest single-day rise on record. Underwriters were deluged with orders for securities they had purchased earlier and had to put on the shelves because of market conditions. Most prominent were American Telephone & Telegraph Co debentures, which went out immediately at a premium.

The Fed picked a dramatic way to ease the money market. That is by announcing a change in the rediscount rate rather than through open market operations. Since the rediscount rate is more of a signal than anything else, Fed succeeded in advertising its change of policy in a hurry.

Business confidence has been really lagging in the last few months. Fed felt that business needed a psychological shot in the arm. The economic indicators haven't been providing much stimulation, eg.,

- Personal income off $1 billion from last month.
- Industrial production off two points.
- Unemployment not going down as it usually does this time of year.

Will the lower rediscount rate help the business climate? Time will tell. Suggest watching retail store and automobile sales. These indices will give the first hint if business starts to head upward. Other changes will probably follow if this latest rediscount change does not help business. One thing to watch will be the weekly statistics showing changes in the reserve position of the commercial banks.

RATES ▶ **A one mill rate increase for farm and residential users** of more than 700 kwhr of power monthly was placed in effect Nov. 1 by the Tillamook County Public Utility District in Oregon. It was caused by increased costs of power, labor, and material, the PUD board said. Increase was made on the "end block" of the rate which went from 7½ mills per kwhr to 8½ mills.

Tampa Electric Co is planning to seek higher rates. Company wants to jack the rate of return to nearly 7% versus less than 6% now.

REGULATION ▶ **Kansas State Corporation Commission considers power service issue.** A warning that the ability of Kansas to attract new industries would be jeopardized if existing dual certificates of authority for electric service were eliminated has been sounded by the Kansas Power & Light Co.

Company was one of several private utilities which filed responses in answer to a petition filed with the KSCC last May 7 by 29 Kansas electric co-ops. These co-ops have asked cancellation of dual certificates, which allow two or more competing companies to serve identical rural areas. KP&L said cancellation of these certificates would change the entire pattern of electric service in the state and would impair service.

Continuing, the company declared that it and other Kansas utilities would be deprived of property rights without due process of law and that existing certificates are part of its assets. These certificates were held by the company and other

utilities prior to the formation of the co-op. For the most part, KP&L declared, company has not opposed the granting of dual certificates to co-ops but has reserved its operating rights in the territories. KP&L summed it up this way: The granting of dual certificates has worked well and that "rural cooperatives have not been injured."

EMPLOYEE RELATIONS

Plans are now being drawn to establish "a rather complete engineering group" at Canton, Ohio, American Gas & Electric Corp Pres Philip Sporn said recently. The group will include engineers and draftsmen and will be a branch of the AGE Service Corp. This group will not only carry out engineering work for Ohio Power Co, which maintains its general offices in Canton, but also for all other operating companies in AGE. As this group expands, other offices may be established in Roanoke, Va., and Fort Wayne, Ind., Sporn said.

In attempt to settle a dispute between British Columbia Electric Co and the Electrical Workers Union, a conciliation board has been set up under the chairmanship of Professor John Deutsch of the University of British Columbia. Company has offered increases up to 15% over a two-year period.

OPERATIONS

Recent commitments of the Brooklyn Dodgers and the New York Giants to move to the West Coast, spotlights the difficulties in making ends meet in professional baseball, even when a team is successful. Increasing trouble in attracting daytime audiences may lead to a larger number of night and twilight games as a solution. Electric utilities may find it profitable to do some promotional work in this direction, particularly where they serve communities which have a baseball club in the major or minor leagues.

PUBLIC RELATIONS

Are you planning to organize a library or an information center? If so, you can get free consulting service by contacting the Special Libraries Association, 31 East 10th St, New York 3. This nationwide service is being coordinated by Florence H. Armstrong, librarian of Ross Roy, Inc, Detroit. "Increased specialization and automation in business and the professions," Mrs Armstrong said, "have doubled the need for libraries or information centers in fields ranging from aerodynamics to zymurgy."

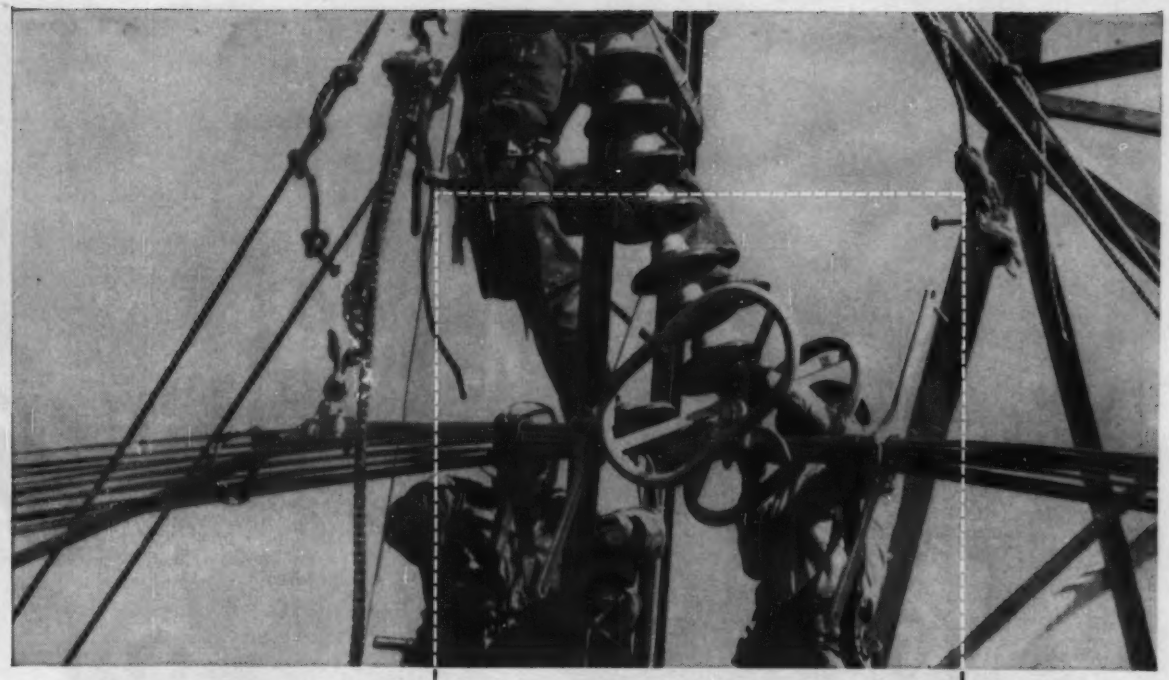
A series of TV programs on atomic energy will be presented over CBS network. It will be seen on Edward R. Murrow's "See It Now." First will include the Shippingport, Pa., nuclear power plant and England's Calder Hall plant.

Kansas City Power & Light Co uses a good selling slogan in its TV ads: "You can operate your television receiver eight hours for only a nickel."

Internal relations take most of the time and energy of the public relations department. This is what a survey of 79 of 149 corporations shows in the November issue of Harvard Business Review in an article, "You have to Manage Public Relations," by Caroline Bird and Thomas D. Yutzy of Dudley-Anderson-Yutzy.

"All to often, a company buys public relations without knowing what to do with it, where to put it or what to put into it," the authors conclude. Frequently public relations departments are blocked off from knowing what's going on in their own companies, or if they do know, they aren't sure whether or how much they can tell the world, the survey shows.

Management needs to choose public relations directors carefully. The article points out that management, lacking yardsticks, sometimes hires "back-slapping, drink-swapping cordiality," instead of a man who can structure an ill-defined job, resist internal pressures from department heads, and understand top management thinking.



When they're *designed together*

they'll perform together!

That's How You Benefit When Both Insulators and Hardware Come From One Manufacturer

Control rings, suspension clamp, and suspension insulators in this installation all come from a single manufacturer.

Why is this important? Consider the control rings on this extra-high voltage line, for example. Should they be designed to control corona on the suspension clamp, or on the suspension insulators?

Rightly designed, they control corona in both areas, if that is a requirement specified by the builder of the line. That means that a designer must have an appreciation for the corona characteristics of both insulators and hardware.

Integration of hardware and insulator performance can obviously be achieved much more readily when they are designed and built by the same people, as they are at Ohio Brass. Then you can be assured that they will perform correctly when installed on your lines.

OHIO BRASS COMPANY, MANSFIELD, OHIO
CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Ohio Brass

4752-H

IS YOUR
NETWORK TRANSFORMER IN
THIS PICTURE?...

or this one? ⟶

(Above) Older type 500-kva network transformer. (Right) New, modern Westinghouse design featuring exclusive Yukon Coolers. Wider fin-spacing, greater floor clearance lowers maintenance costs, simplifies repainting.

New network transformer 12" lower,

When ghosts of the past materialize around utility installations, they can be downright inconvenient—and almost always costly.

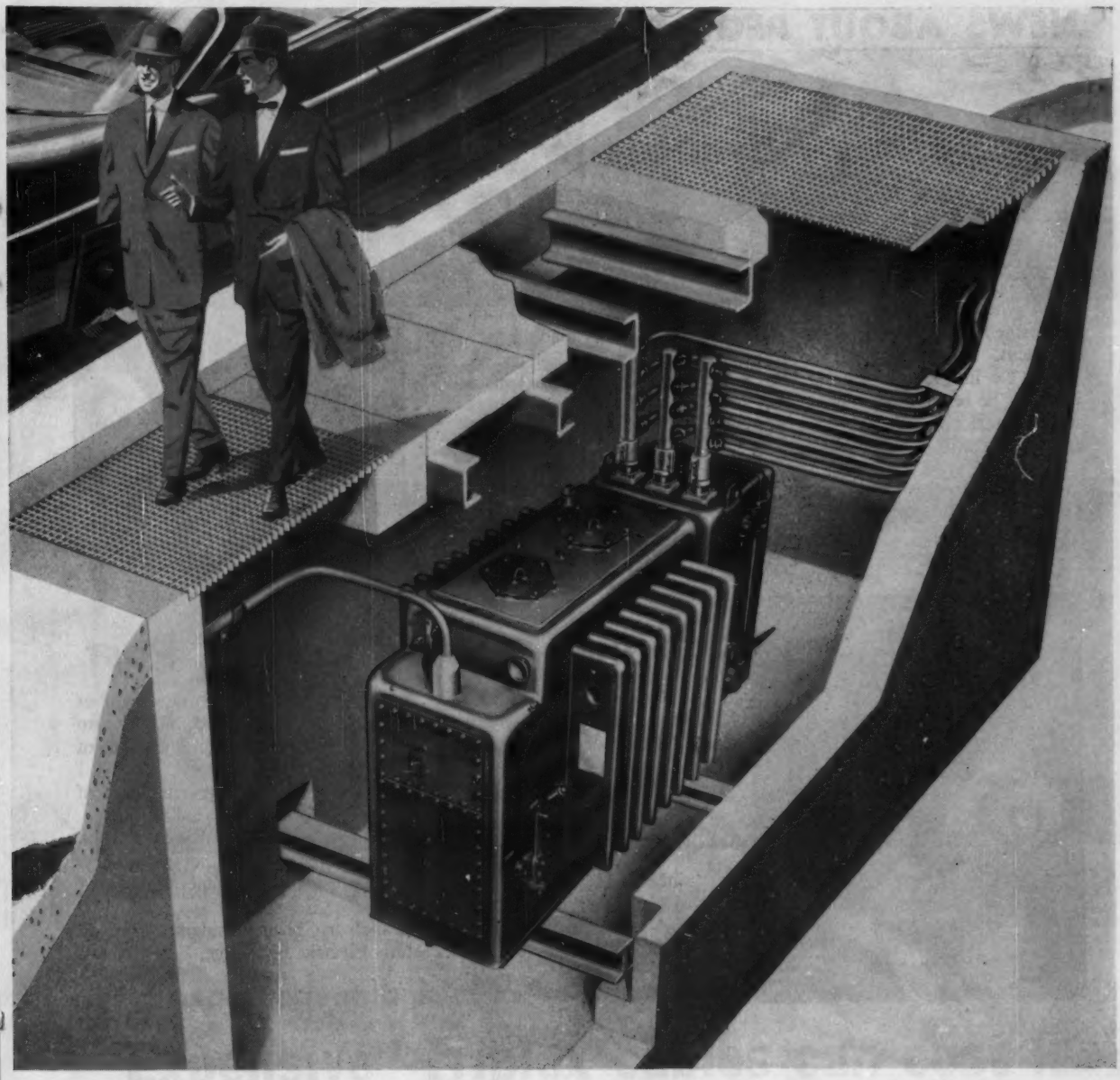
A real ghost chaser, the new Westinghouse Space-Miser network transformer's modern design ends old-fashioned, expensive maintenance. It puts network operation in a brand-new setting. Here's how . . .

PERMITS OFF-THE-FLOOR MOUNTING. Corrosive debris which falls into vault is kept from transformer tank.

SAVES MAINTENANCE TIME, COST. New contour tank design with Yukon Coolers eliminates sharp edges where it is difficult to provide adequate paint protection. Sheds corrosive media like a duck sheds water. Maximum accessibility of all painted surfaces simplifies inspection and maintenance.

SLASHES INSTALLATION COSTS. Weight reduced 20%—faster, easier installation, safer handling.

EASILY ACCESSIBLE HIGH-VOLTAGE TERMINAL CHAMBER. Lowered switch and terminal chamber make sharp cable bends



20% lighter, saves 15% vault space

unnecessary. Four inches extra width inside terminal chamber eases the job of forming and connecting H. V. cable.

THE SPACE-MISER NETWORK TRANSFORMER has been made possible through modern design techniques. It retains the same overload ability as older designs while minimizing network operating and maintenance problems.

For more information call your Westinghouse representative...or write Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pa. J-70810

YOU CAN BE SURE...IF IT'S

Westinghouse

McChesney Advances to VP

P. E. McCHESNEY

Arkansas Power & Light Co has announced the election of P. E. McChesney as vice president of the utility. Prior to his recent promotion, he had served as an administrative assistant in AP&L's executive offices since early in 1951.

McChesney's 40-year career in the electric utility field began in 1917, when he joined Gulf States Utilities Co as its only salesman. He formed the sales department and subsequently was made a vice president. From that post he transferred to Virginia Electric & Power Co in 1936 as general sales manager. Moving to Arkansas in 1941, he became president of Arkansas Utilities Co. He later was named president of Capital Transportation Co, a position he held from 1947 until its sale by AP&L in 1950.

HARLLEE BRANCH, JR

Branch Named to MPC Post

Harllee Branch, Jr, has been elected vice president and a member of the board of directors of Mississippi Power Co. Branch is also president of the Southern Co, the holding company for a number of utilities in the area, including MPC.

He was named to fill the position created by the recent death of Eugene A. Yates.

Before his appointment as head of Southern early this year, Branch had served as president of Georgia Power Co, another subsidiary, since 1951. He has also been vice president and general manager of Georgia Power.

A leader in the utility field, Branch has been president of Edison Electric Institute and Southeastern Electric Exchange.

Raymond Promoted

R. E. RAYMOND

Richard E. Raymond is the newly named superintendent of transmission and distribution for Florida Power Corp.

Raymond, whose experience with the utility dates back to 1939, earned his electrical engineering degree from University of Florida.

At present, he is also serving as secretary-treasurer of American Institute of Electrical Engineers.

PSP&L Ups Knight

DAVE KNIGHT

Dave Knight has been chosen to fill the new position of supervisor of system operations at Puget Sound Power & Light Co.

In this capacity, he will be in charge of daily power supply operations and of following the progress of current power construction projects in the area. Knight is former PSP&L representative on the Inter-company Pool staff in Spokane.

1. MID-SPAN TAPS help bring down the over-all cost of distribution with Rome's Triplex SD and secondary cable. You can tap between poles from either side, using conventional hardware plus a spreader block. Simple; fast; saves service wire. You save on pole cost, too—*as much as one-third*. With Rome's Triplex secondary you can span 300 feet from pole to pole. Use fewer poles; save time setting them; eliminate crossarms.

2. SAVE ON HARDWARE. Here's a comparison between the hardware needed to install one open-wire service drop (right)—using one pole—and Rome's aluminum Triplex equivalent (left) using a mid-span tap.

3. CUT MAN-HOURS on installation jobs. Triplex goes up much faster than open-wire service, because it requires less handling, less time installing hardware. It's easier to handle, too—aluminum cable assembly weighs less than conventional copper service wires.

If you take advantage of these important savings . . .

"Expensive" Triplex cables can cost less

Triplex sometimes *does* cost more than its open-wire equivalent.

But its on-line cost can be lower—*if you take advantage of the installation economies* that Triplex alone makes possible.

Fewer poles . . . less hardware . . . faster installation—these are the savings you make with Triplex. They can more than offset any extra cable cost.

In addition, there are many locations where you can improve service and reduce maintenance with Rome's aluminum Triplex. Wooded areas, for example—where Triplex *stays up* despite falling tree branches that might knock out open-wire secondaries. Residential streets, too—where good public relations indicates need for a neat, uncluttered installation.

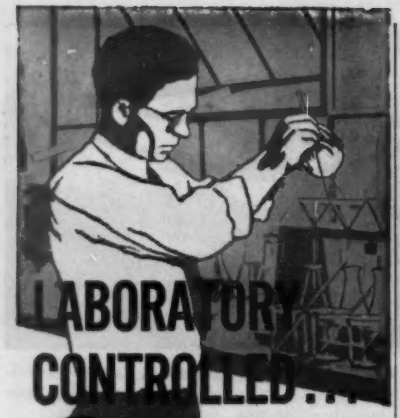
Fits your modernization pattern

Introduced 10 years ago, Rome's Triplex SD Cable won almost immediate acceptance. As a next step in modernization, many utilities are now using lightweight aluminum Triplex for overhead secondaries as well. If you haven't yet adopted this practice, we invite you to look into the operating advantages—as well as the economies—that this Rome "package" concept offers you.

Specify Rome's aluminum Triplex for your next job. For more information, contact your nearest Rome Cable representative—or write to Department 368 and ask for descriptive Bulletin RCP-361. Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION



Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

Copperweld Ups Darbaker

James M. Darbaker, president of Copperweld Steel Co, has been named to the additional position of chief executive officer to succeed the late Frank R. S. Kaplan. He will also serve as acting chairman of the board of directors.

A mechanical engineering graduate of University of Michigan, Darbaker, joined Copperweld in 1954 as senior vice president. He had previously been with U. S. Steel Corp in administrative, production, and sales capacities.

Adams Is Elected VP

Recently elected vice president in charge of news operations for Bozell & Jacobs, Inc, was Wayne Adams, former news director.

Adams will now assume responsibility for supervising all news reporting activities of the firm's New York, Washington, and Baltimore offices. He will also provide supporting services to nine other offices in Chicago, Hollywood, Seattle, Omaha, Kansas City, Houston, Shreveport, Minneapolis, and Indianapolis.

PERSONAL BRIEFS

New assistant operating manager of Puget Sound Power & Light Co is **Richard P. Mortell.** His former post of superintendent of the division of power supply goes to **Emmet P. Kelly.**

Aaron E. Newcomb has been named first superintendent of the 100,000-kw Dave Johnston steam plant being built by Pacific Power & Light.

Cleveland Electric Illuminating Co has named **Charles E. Richards** as assistant general superintendent of the Steam Power Division, power production and engineering group . . . **Daniel E. Greene** was recently made labor relations manager at Duquesne Light Co.

Virginia Electric & Power Co has advanced **Jesse R. Slack** to superintendent of mechanical equipment, system power department; **Henry S. Frank** to superintendent, Possum Point power station; and **Charles B. Beverage,** to mechanical supervisor at Possum Point.

Oliver D. Bennett has been promoted to supervisor of rights of way for the Bay, Coast, and Southern Divisions of Jersey Central P&L.

At Duke Power Co, **William E. Apple, Jr,** was named assistant manager at the Burlington branch; **S. C. Lynch,** electrical superintendent; and **Ralph L. Asbury,** director of accounting methods and procedures.

Minnesota Power & Light Co's **Gust E. Robertson** has retired as superintendent of hydro production after over 45 years with the utility . . . **Hugh B. Parris** has retired as vice president and treasurer of Dallas Power & Light Co but remains a member of the board of directors.

John Tindall has become superintendent of construction for the Fort Wayne (Ind.) municipal light plant . . . American Public Power Assn has named **R. L. Schacht** of Consumers Public Power District as vice chairman of its atomic energy committee.

Recently named as marketing directors for major product divisions at Westinghouse Electric Corp were **S. F. Davies,** General Products; **L. H. Loufek,** Apparatus Products; and **R. M. Wilson,** Defense . . . **J. W. Stirling** will head the firm's circuit breaker plant which will be erected at Trafford, Pa. . . . The Lamp Division has as its new national accounts sales manager **Robert J. Sampson . . . Dr. Clarence Zener,** director of Westinghouse Research Labs, has been awarded the Society of Rheology's Bingham Medal for his research with metals.

Daniel H. Miller has been promoted to manager of Square D Co's Western Division . . . Hotpoint Co's commercial equipment department recently named **Robert S. Baldwin** Tennessee zone manager.

Allis-Chalmers Manufacturing Co has appointed **Howard C. Carless** as assistant general manager of the Terre Haute Works. At the Boston Works, **Werner K. Steuernagel** was made a circuit breaker application engineer and **Gordon W. McLaren,** application engineer.

Gilbert Associates, Inc, has appointed **James R. Stoudt** as manager of the Nuclear Energy Division . . . **Arthur F. Uhrlandt** is new director of field sales for Crouse-Hinds Co.

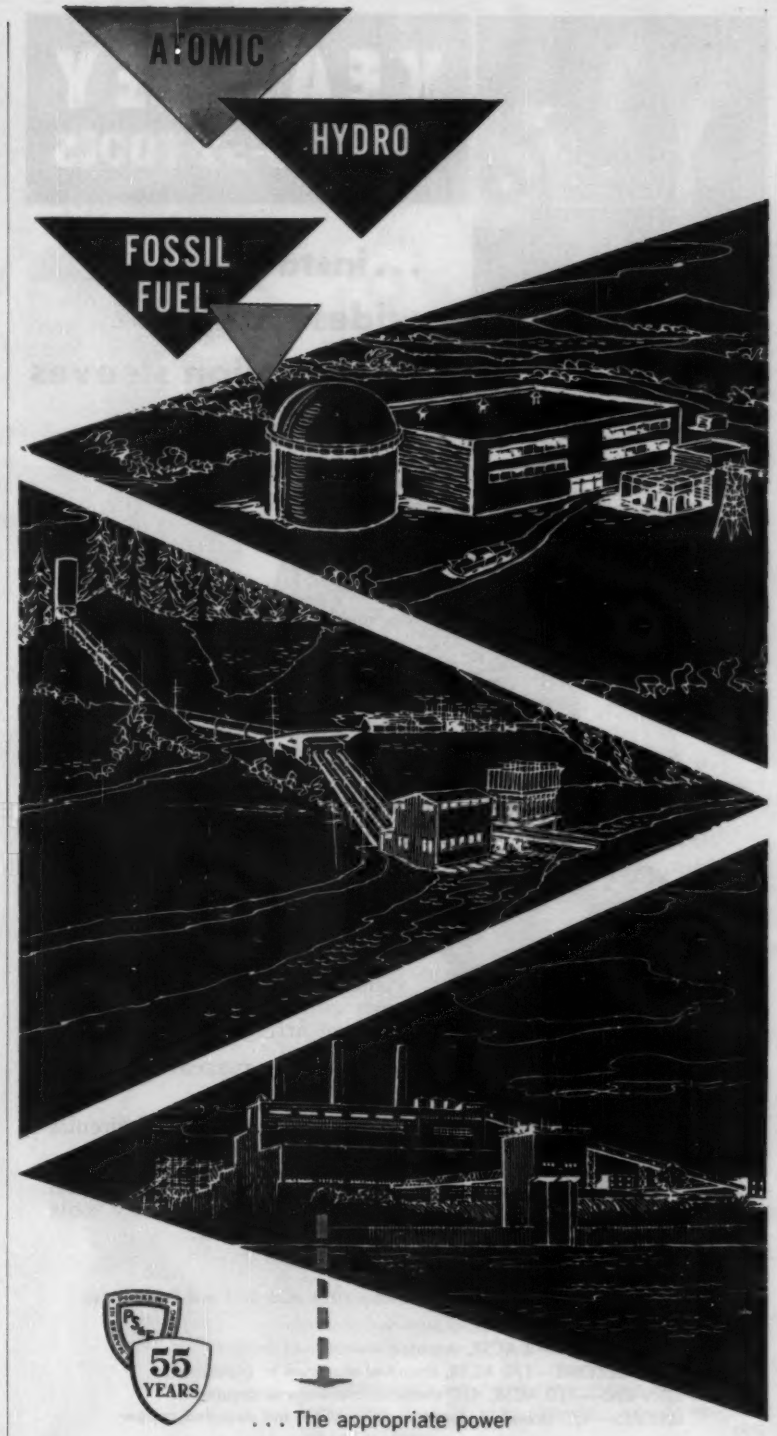
At Buffalo Forge Co, **J. Barrie Graham** has advanced to director of research and **Richard D. Madison,** to consulting engineer for the firm.

John R. McAllister replaces retiring **William MacMurtrie** as manager of purchasing in Philco Corp's Government & Industrial Division . . . Stone & Webster Engineering Corp has named **Charles R. Claxton** assistant chief engineer, Nuclear Projects Division.

OBITUARY

Joseph T. Schilling, 64, retired executive vice president of Iowa Power & Light Co, died recently.

H. W. H. Wellington, 64, assistant to the president of Boston Edison Co, died recently at his Boston home. He once was vice president of electric and steam operations.



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. . . The appropriate power for your expanding program

Send for our descriptive booklet, "Pioneering New Horizons" of these and other services.

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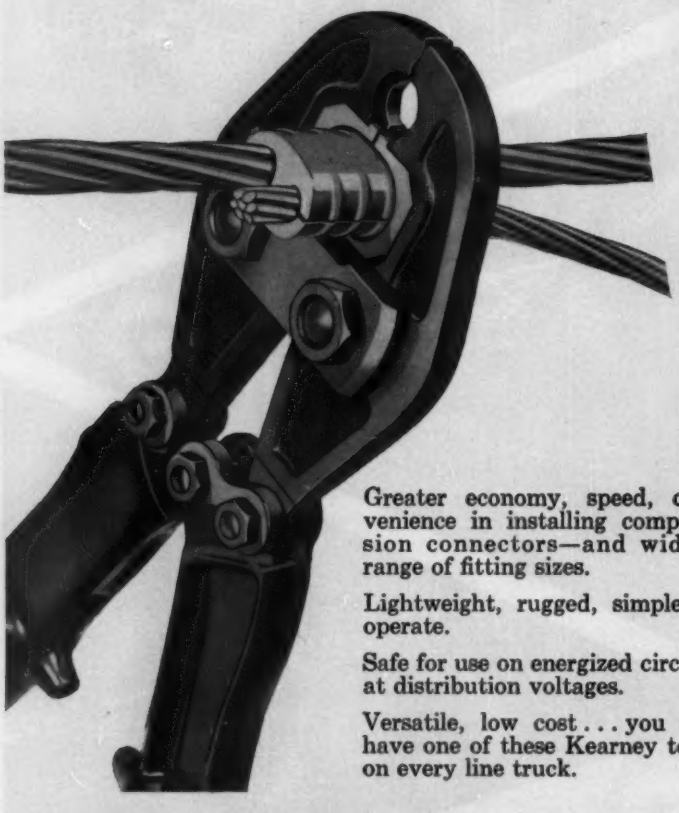
Self-aligning, identical die halves lock rigidly into place, are held securely seated by spring locking pins—yet are easily snapped in and out with fingers.

KEARNEY 0-51 and 0-52 TOOLS

...install widest range of compression sleeves and fittings



Greater economy, speed, convenience in installing compression connectors—and widest range of fitting sizes.

Lightweight, rugged, simple to operate.

Safe for use on energized circuits at distribution voltages.

Versatile, low cost . . . you can have one of these Kearney tools on every line truck.

Make connections through these line wire sizes with 0-51 and 0-52 Tools:

SQUEEZONS, 4/0 ACSR, or stranded aluminum
L-SQUEEZONS—2 ACSR, stranded aluminum or copper
T-SQUEEZONS—1/0 ACSR, stranded aluminum or copper
SERV-ENS—1/0 ACSR, 4/0 stranded aluminum or copper
SLEEVES—4/0 stranded aluminum, 2/0 ACSR and stranded copper

373R

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for BETTER CONSTRUCTION SAFER MAINTENANCE *Specify* **KEARNEY PRODUCTS**

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READERS FORUM

". . . All Shook Up."

To the Editor:

While belatedly reading my home copy of the September 30, 1957 Electrical World, I noticed your editorial "Is Russia ahead in DC Transmission?" Needless to say "I was all shook up" when I read the comment. "In the U. S., however, the problem is to transmit blocks up to 1,000 Mw for distances of 100 miles or so between terminals —a service within the proven capability of 345-kv ac transmission."

Ever since the thirties, large blocks of power have been transmitted approximately 300 miles from Hoover Dam to Los Angeles over 220 and 287 kv lines. Of course, that was on the West Coast where things are done in a big way. In contrast, for many years on the East Coast the need has existed to transmit power some 300 miles from the coal regions to the coastal areas, but nothing was done about it because we were content to let the railroads haul the fuel.

This East Coast transmission situation is a sad commentary on the electric utility industry—a sort of "Sputnik"—because recently we suddenly awoke to the fact that coal prices were rising and the main cause of the rise was a periodic hiking of coal transportation tariffs. To meet this situation some 26 electric utilities protested to I.C.C. about high rail rates for coal. A spokesman for one of the electric utilities in Virginia even went so far as to indicate that his company would use natural

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gas transmitted from Texas as fuel under the boilers in spite of the fact that coal is one of Virginia's main products. Oblivious to the apparent success of 287 kv transmission from Hoover Dam and the more recent success of AG&E's 345 kv transmission, we still are content to put up with high rail rates for coal instead of using the electric utilities proven tool of bulk power transmission. Can it be that in the East bulk transmission is only reliable between 100 mile terminals?

Let's face the facts. The trouble is our worship of the sanctity of public utility service area boundaries coupled with professional rivalries between vested interest and our imaginary belief that public opinion is averse to utility system bigness. If that statement is incorrect, then why are we not transmitting coal by wire from the coal fields to Philadelphia, Baltimore, Washington, D. C., Richmond, Norfolk and other East Coast cities?

Urges Regional Systems

Suppose we examine the situation. Think of the benefits that would accrue to the rate payers and the investors if the service area of one integrated electric system covered the States of Maryland, Virginia and West Virginia—the latter being the major coal producing state in the country. This setup would permit the use of million kilowatt units for the generation of power in the West Virginia coal fields, and the transmission of bulk power at 345 kv to such market centers as Baltimore, Washington, Richmond and Norfolk. As for Philadelphia, one electric utility serving the whole State of Pennsylvania would cure that situation because the delivered price of coal in Philadelphia is almost twice that in Pittsburgh.

Mr. Editor, one of the problems in this country is to transmit power distances of 300 miles or more between terminals with a single utility serving the mining area and the market. Unless our politico-corporate situation is revamped to permit such state-wide and regional systems, the electric utility industry will not be in a position to take full advantage of the technical know-how available to it.

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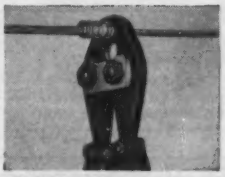

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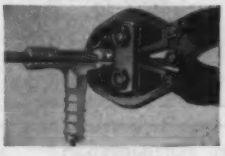

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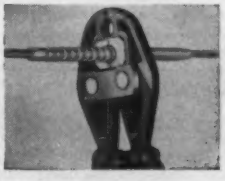

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Advertising in This Issue

AMP Incorporated 52, 53
Advertising Council, Inc. 147
Allis-Chalmers Mfg. Co. ..... 2nd Cover 8, 9
Aluminum Co. of America 41, 42 43, 44
American Chain & Cable, Page Steel & Wire Div. 128
Anaconda Wire & Cable Co. 118, 119
Anderson Electric Corp. 16, 17

Babcock & Wilcox Co. 68, 69
Baldwin-Lima-Hamilton Corp., Pelton Div. 46
Blackburn Corp., Jasper 10
Brown Company 134

Chance Co., A. B. 117
Chase Brass & Copper Co. 28
Collyer Insulated Wire Co. 18
Combustion Engineering, Inc. 30, 31
Copperweld Steel Co. 58

Directory of Engineers 164
Duncan Electric Co., Inc. 135
du Pont de Nemours & Co., (Inc.) Elastomer Chemicals Dept. ..... 125 Polychemicals Dept. 72, 73

Eastern Specialty Co. 110
Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc. 121
Electrical World 139
Electroline Company 14
Engineers, Directory of 164

Fargo Mfg. Co., Inc. 140
Federal Pacific Electric Co. 3rd Cover
Ferranti Ltd. 131

General Cable Corp. 55
G&W Electric Specialty Co. 132, 133
General Electric Co. Apparatus Dept. 101, 102, 103, 104 106, 107, 108, 109, 136 137, 145, 149, 150
Grinnell Co., Inc. 71
Guaranty Trust Co. of N. Y. 61

Holan Corp., J. H. 130
Hubbard & Co. 113

I-T-E Circuit Breaker Co. R&IE Equipment Div. ..... 26, 27 Small Air Circuit Breaker Div. 45
Indiana Steel & Wire Co., Inc. 160

Johns-Manville 62

Kaiser Aluminum & Chemical Sales, Inc. 142, 143
Kearney Corp., James R. 162, 163
Kellogg Co., M. W. 60
Klein & Sons, Mathias 144
Kuhlman Electric Co. ..... 4th Cover

Lapp Insulator Co., Inc. 38, 39
Leeds & Northrup Co. 70, 116
Line Material Industries 74, 75, 76

Macallen Co. 66
Mallory & Co., Inc., P. R. 11
McCabe-Powers Auto Body Co. 15
Minneapolis-Honeywell Regulator Co., Industrial Div. 129
Moloney Electric Co. 12, 13

Nelson Electric Mfg. Co. 138

Ohio Brass Co. 25, 54, 155
Okonite Co., The 4

PLM Products, Inc. 146
Page Steel & Wire Div., American Chain & Cable 128
Pennsylvania Transformer Div., McGraw-Edison Co. 19, 20, 115
Pioneer Service & Engineering Co. 161
Preformed Line Products Co. 29

RT&E Corp. 40
Reliable Electric Co. 63
Roebling's Sons Corp., John A. 111
Rome Cable Corp. 159
Royal Electric Mfg. Co., Inc. 112
Ryerson & Son, Inc., Jos. T. 166

S&C Electric Co. 6, 7
Sangamo Electric Co. 59
Searchlight Section 165
Simplex Wire & Cable Co. 50
Smith Co., S. Morgan 56
Southern States Equipment Corp. 51
Square D Company 67
Standard Oil Company 57

Thiel Tool & Engineering Co., Inc. 166
Tobe Deutschmann Corp. 34, 35

United States Steel Corp. 122, 123
Utility Tool & Body Co. 162

Wagner Electric Corp. 32, 33
Westinghouse Electric Corp. 36, 37 47, 48, 49, 64, 65 126, 127, 156, 157

■

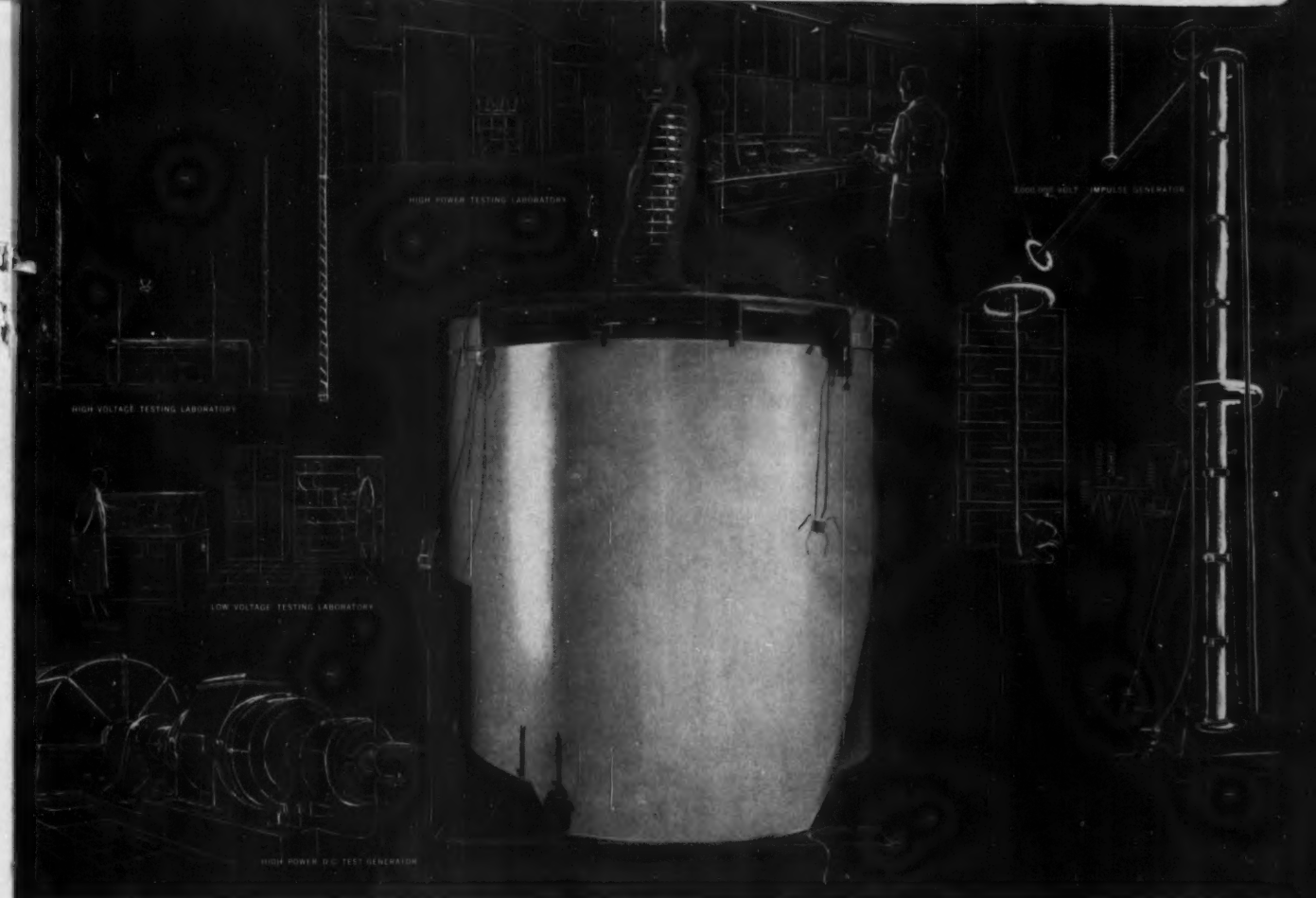
PROFESSIONAL SERVICES 164

■

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 165

EQUIPMENT (Used or Surplus New) For Sale 165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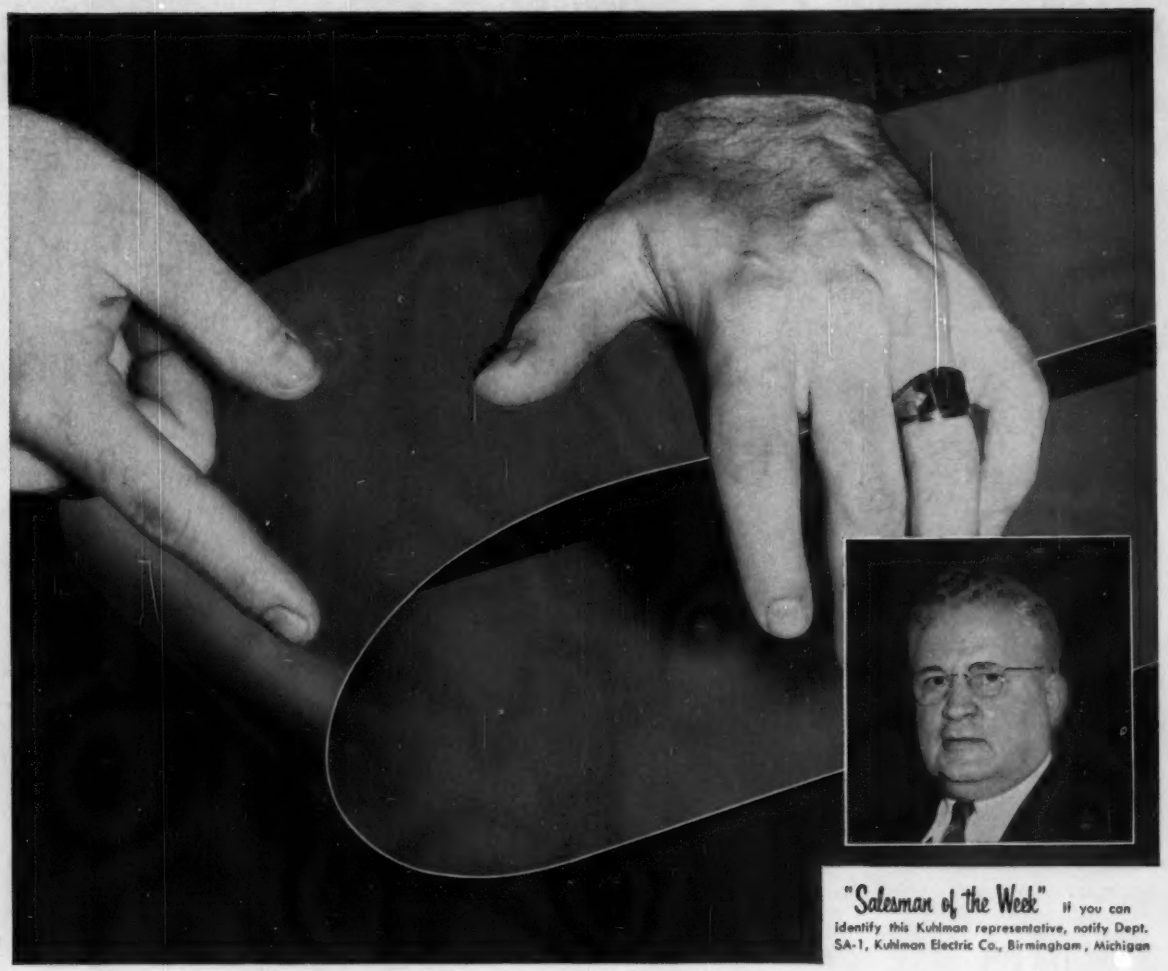

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